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Rural Electricity Supply.

ALTHOUGH Parliament has resumed its sittings we fear that the long-promised statement of the Cabinet with regard to its electrical policy will not be made for some weeks to come. The report of Lord Weir's Committee was presented to the Minister of Transport on May 20th—exactly six months ago—and yet, apart from more or less intelligent forecasts on the part of an enterprising Press, followed by official denials from persons in authority, the subject has remained shrouded in mystery. Does the Government realise that the result has been to put a brake upon the wheels of progress? Uncertainty as to the future is fatal to enterprise; it is better to know the worst than to be tormented with doubt, and whilst we have serious misgivings as to the intentions of the Cabinet, anything would be better than continued suspense. It is generally assumed that the policy under consideration involves a heavy capital outlay, and that the delay is largely due to the difficulty of finding the money, a theory which certainly has an air of probability, and is accepted as fact by the gas companies, which lose no opportunity of vigorously protesting against the subsidising of electricity supply by the State. We sympathise with them, feeling that the benefit of such a subsidy would be outweighed by its accompanying disadvantages. But is there not plenty of scope for progress, without awaiting further legislation?

One of the most important subjects to which the Electricity Commissioners might usefully turn their attention is that of rural electricity supply. That development in this direction is more and more engaging the activities of supply station engineers in provincial centres is evidenced by the articles and letters which have appeared in our pages, by recent references in the proceedings of the Institution of Electrical Engineers, and by communications which have reached us from other sources. In this issue Major T. Rich tells us of the progress that is being made in France, and illustrates some of the overhead construction employed for that purpose, which is conspicuously free from costly and dangerous safeguards such as that to which Mr.

W. Fennell recently drew attention. We notice that our agricultural contemporaries devote a considerable amount of space to the subject, and call for cheaper methods of distribution as the first step towards the electrification of the farm. In his presidential address Mr. R. A. Chattock referred to the high cost of distribution, and opening a discussion at the Informal Meeting a few weeks ago he gave some particulars of the interesting methods adopted by Mr. J. T. H. Legge in the Shropshire area, which brought the cost of construction down to about £400 a mile. (But that is still too much.)

In his inaugural address to the North-Eastern Centre of the I.E.E., the chairman, Mr. R. W. Gregory, referred to the legal restrictions which hamper the electrical industry compared with the conditions abroad, and said our high ideals of service and public safety combined to make electrical distribution too costly for rural districts; rural electrification deserved the study of all supply engineers, and the essential to the solution of the problem was the reduction of the capital cost even at the expense of the service given—a 90 per cent. service was much cheaper to give than a 99.9 per cent. service, and the former was all that was necessary. Cheap h.p. distribution lines were necessary to supply farms and villages, and the existing regulations should be relaxed; the ice loading figures in particular were needlessly severe, and from £50 to £80 a mile could be saved in this respect. "The dangers of overhead lines to human life with modern methods of construction and protection are infinitesimal."

Mr. J. W. Burr, of Swansea, similarly addressing the Western Centre, emphasised the necessity of reducing the cost of distribution in rural districts; and Mr. J. P. Thompson, in his address to the Dundee Sub-Centre, said electricity should be brought within reach of as many farms as possible—it could not be done too soon. In his own area a supply was already given to some 50 farms, and he knew how greatly its advantages were appreciated by the farmers. Again, Mr. A. G. Ellis, chairman of the North-Western Centre of the Institution, said the development of rural electricity supply for agriculture was a subject which was at last receiving the attention it deserved. It presented an enormous new field with a possible demand of from 500 to 1,000 million units per annum. He devoted much attention to this subject, and pointed out that cheap power supply was largely dependent on the cost of transmission lines and of tapping them. The regulations for the construction of overhead lines should be simplified, and he hoped the Electricity Commissioners would exercise their influence in that direction. It could surely be left to the common sense of electricity undertakings to see that their lines were both safe and sightly.

We may remark that the addresses from which we quote are exceptionally interesting and well worthy of reading *in extenso* when they appear in the *Journal* of the Institution. That so many of them should dwell upon the importance of rural electricity supply and of less restrictive regulations cannot be a mere coincidence—it indicates an awakening to the needs of the rural population, which can only be met by cheaper distribution.

An Electrical Fair.

If the hopes and expectations of the Government and of the organisers of the British Industries Fair are realised, that event in February next in London and Birmingham will reach a record level. We profoundly trust that such will be the case, for we believe that the time has arrived when a truly representative effort of this kind, as distinct from the ordinary exhibition, will give a splendid boost to the sale of British-made goods in our export markets. To our minds it is not right that Fair after Fair should be allowed to pass without the electrical trade participating on a reasonable scale and in a more or less specialised way suited to a Market Fair rather than an Exhibition as it is generally understood by electrical men. We are not for a moment suggesting that there shall be an exhibition, either in London or in Birmingham, of large electrical manufactures, but there are many classes of electrical goods and apparatus which could appropriately and profitably be displayed when so many foreign and Colonial buyers are visiting these shores to find out what British manufacturers and traders have for sale. Some electrical manufacturers have applied for space already, but we urge many others seriously to consider their attitude and try to give the Fair, at any rate at Birmingham, an electrical reputation which will bring more electrical buyers. As we have already stated, special funds have been allocated by the Government to give the Fair full advertisement in the countries from which visitors are desired, and the electrical industry should, somehow or other, secure its share of the advantage accruing from such publicity. It has been hoped again and again that the British Industries Fair would become an event of such popularity and dimensions as to do for our trade what Leipzig has for years past done for Germany. We think that such an end is not only desirable, but is attainable, and we put it to electrical traders that they should make a strong feature of their products at Birmingham next year. We are not concerned so much with whether they have individual stands as they have had on some former occasions, or whether they have grouped and co-operative collections of electrical apparatus, devices, domestic appliances, switches and switchgear, fittings, materials, cables and wires, and so on, which can be more or less easily brought together and treated as a trade demonstration. An effort for export trade hardly falls within the scope of either the E.D.A. or the E.C.A., but possibly the Cable Makers' Association, the Electrical Accessories' Manufacturers' Association, or certain groups within the B.E.A.M.A., might consider it worth while to provide the funds for a moderate exhibit. The thing is, in our estimation, well worth trying. If the results proved satisfactory it would be easy to decide whether the Fair would have a permanent Electrical Section. That we can leave for the present, but so far as 1926 is concerned the buyers are being invited in their thousands. It is for us all to see that they find electrical products on sale—chiefly, of course, at Birmingham.

On Reading the "Electrical Review."

In the preparation of the ELECTRICAL REVIEW we follow as far as is humanly possible a definite order and plan so that the regular reader will know just where to find any particular section or feature. It is our aim to facilitate reference to information collected by our elaborate organisation so that contents, whether of an advertising character or of news service, may be promptly used. Having finished this part of our work with efficiency plus due humility, we leave it to the usual organisations to see that the REVIEW reaches the hands of those whose interests it is designed to serve. But have we not the right to inquire whether the mass of material thus prepared and distributed is made use of with the same efficiency as marks its production?

Much has been said about how to write for the Technical Press, but there is need for advice to be given how to read it. We refrain from a general homily and concentrate upon one aspect of the question which has been impressed upon us again and again.

Electrical companies, through their directorate and management, recognise the need for ordering a certain number of copies of a journal for circulation through so many departments, each copy being marked to pass through the hands of certain specified members of the staff. There is no better system of ensuring that every member is kept up to date in his study of technical, trade, and financial development if this wheel of service be kept in continuous revolution, but if it has to touch too many men in passing, it is subject to stoppages, delays, the journal receives only hurried glances—not even a casual study perhaps if one is pressed for time, and sometimes it happens that the man whose name is at the bottom of the list receives the copy after other and later issues have begun the round. Two points at least emerge from a study of this matter. One is that

no circulating arrangement can expect to be efficient which requires a single copy to cover too many members of the staff; the expense is so slight in proportion to the value of the service that no concern zealous for the up-to-date mental equipment of its officers can afford to economise here. The other point is the need for staff men to have their own copies of their technical paper to read in the train, or at home. We urge a more general personal use of the ELECTRICAL REVIEW; the regular personal possession of his own copy by every man anxious to succeed in his electrical calling; and the more generous provision of office and departmental copies. The main thought that is in our minds in setting down these observations is the desire that the publication that we produce shall be utilised to its maximum efficiency for the benefit of the industry and those engaged therein.

Radio Wave-lengths.

THE practice of publishing nominal wave-lengths which are not utilised by radio-broadcasting stations and varying from time to time those actually in use, by accident or design, is a very questionable policy. When one station varies its wave-length, several others very soon do likewise in order to mitigate interference; such proceedings cause endless inconvenience and annoyance, and no sooner is the trouble settled in one locality than it is restarted from another source, as was forcibly demonstrated in the tests carried out last summer by the Geneva International Broadcasting Bureau in connection with the unenviable task it set itself of readjusting European wave-lengths. It would seem to be very desirable that it should be made obligatory that each and every station shall adhere strictly to its particular wave.

Moreover, a few metres must be left free on either side of every wave-length used, because a station swings when modulating. The swing increases as the wave is lengthened, and it therefore appears that much shorter waves than those in present use will have to be sanctioned for broadcasting purposes sooner or later so as to make it possible to accommodate the largest number of stations with maximum free zones between them.

Elsewhere in this issue Mr. W. Moon suggests that when selecting wave-lengths for new stations, reference should be made to a schedule in which the wave-lengths are arranged in geometrical proportion, so that they may be equally spaced as regards interference with each other. It would seem that the habit of measuring wave-lengths in metres will have to be abandoned. Because the amount of separation between short-wave stations need not be nearly so great as that necessary between long-wave stations, the requisite "free-space" to eliminate jamming cannot be simply expressed in metres of wave-length. If, however, the kilocycle definition were adopted generally, the estimation of interference reduction would be much simplified, for wave-lengths could then be allocated in exact multiples of 10 kilocycles.

The Coal Trade Inquiry.

ON Wednesday last week the Coal Commission heard the evidence of Sir John Snell, chairman of the Electricity Commissioners, on the relations between the development of electricity supply and the nation's consumption of coal. Anticipating, no doubt, the Report of the Commission for the past year, the issue of which has been awaited for some weeks but is, we believe, now pending, Sir John said that at the end of 1924 the consumption of electricity per head of population in this country, including both public and private generating plant, was estimated at 220 kWh. It is interesting to observe that even to-day it is believed that the output of private plant is not much less than that of the public supply systems; had it been wholly provided by the latter, their load factor would have been much better and electricity would have been cheaper all round. Sir John expects that in 15 years the consumption will have reached 500 kWh per head per annum, the total being increased from 7,000 to 21,000 million kWh per annum. However, the amount of coal consumed by the electricity supply industry will increase only from 8 to 17 million tons, owing to the greater efficiency of the modern generating plant concentrated in large power stations, and the coal consumption of the whole country will diminish as the result of improved efficiency on the one hand, and the replacement of the open domestic fireplace by gas and electrical heating systems on the other, together with the electrification of the railways. The reduced demand for coal will be offset by the development of other British industries resulting from the cheapening of power.

Apart from the actual figures, all these points were dealt with in the Ministry of Reconstruction's report, the recommendations of which are being carried into effect by the Electricity Commissioners; that the progress made during the past seven years has been so slow is largely due to the limitations imposed upon the powers of the Commissioners by Parliament, the removal of which, as they hinted in last year's report, may be necessary if they are to fulfil their primary mission. Even now their hands are tied by the Government's delay in dealing with the report of Lord Weir's Committee.

With regard to the lack of success in bringing about comprehensive amalgamations, Sir John said there was a tendency to try to retain the local generating station in the face of a cheaper alternative, and whilst he would not express an opinion as to whether the Commissioners should be armed with further powers of control, he stated that his estimate of the consumption 15 years hence was not based on normal development without legislation, for he assumed that further powers would be given to them. Taking this admission in conjunction with the fourth report of the Commission, and his remark in reply to the chairman that the matter was under the consideration of the Government, we need not be at a loss regarding the opinion which he withheld.

Finsbury Technical College.

THE very successful dinner of the Old Students' Association of Finsbury Technical College that was held at the Engineers' Club on Saturday last, afforded no symptom of approaching dissolution, so far as the Association was concerned; unfortunately the College itself is not in so happy a position. Failing something in the nature of a miracle, we fear its doom is sealed; owing to the financial stringency resulting from the war, the City and Guilds of London Institute, the London County Council, and the Board of Education are unable to continue the contributions to the funds which they guaranteed for five years in 1921, and consequently the doors will close next summer.

Thus will come to an end a career of over 40 years, during which, by the genius and capacity of its teaching staff, including such men as Ayrton, Perry, Silvanus Thompson, Armstrong, Meldola, and their distinguished successors, the College has earned world-wide renown.

We are glad of this opportunity to draw attention to the efforts exerted by the Council of the O.S.A. to avert the impending fate of the College—especially by the special Committee appointed for the purpose, comprising Messrs. E. S. Conradi, A. J. Chapman, and H. D. Symons. The self-sacrificing industry and resourcefulness of these gentlemen has been beyond praise; they have left no stone unturned in their endeavours to obtain the financial support and personal influence necessary to attain their object, and if the result has been failure, it has not been for want of trying. The lovers of Finsbury owe them a debt of gratitude.

We believe the situation could still be saved if some public-spirited person would come to the rescue with substantial funds. Failing that, the only gleam of hope lay in a suggestion put forward by Prof. Hale, that the College might become a centre for the promotion of chemical engineering. The Department of Applied Chemistry has a distinguished record of achievement, and might possibly be extended to fill the need for such an institution as that mentioned above. We trust that this, at least, may be accomplished.

Recovering Fuel from Ash and Clinker.

Some Modern Methods of Separation.

By C. H. S. TUPHOLME.

To the majority of power-house engineers and fuel technologists the term "fuel economy" generally conveys the impression of burning fuel more efficiently, by the employment of correctly-designed furnaces, and attention to draught regulation, fuel firing and fuel-bed thickness. Vital though these considerations are, there is another aspect of fuel conservation which is only too often overlooked; that is the recovery of combustible matter from ash and clinker normally discharged as worthless. Considerable success in this direction has already been achieved in Britain, and there is now available a number of separators and fuel-recovery machines which have proved well worth their initial outlay. Not only tests, but every-day operation, have shown astonishing results in separating combustible material from real waste. There is no doubt that in all industrial plants the enormous quantity of valuable combustible matter present in the ashes and clinker discharged from the fires is a source of waste seldom fully realised. In the ashes removed from boiler furnaces the proportion of combustible sometimes approaches 20 per cent., equivalent to a loss of some 3 to 5 per cent. of the original fuel. Obviously here is a direction in which a definite contribution to the conservation of fuel can be made. For the recovery of fuel from ash, two systems have been developed in Europe: (1) Physical; (2) electrical. In Britain attention has been paid chiefly to the physical methods of recovery, while in other countries considerable progress has been made with other methods. These processes make use of the fact that when two solids, the one heavy and the other light, are mixed, their separation may be effected by immersion in water, when the heavier will sink more rapidly than the lighter; or, if one substance be lighter than water, then this will float on the surface, while the heavier will sink to the bottom. Coke is heavier than water, but, owing to its porosity, its apparent specific gravity is nearly identical with that of water, with the result that until it becomes saturated it sinks very slowly.

Regarding the specific gravities of the substances in the mixture, considerable variation is found, but the average of a number of tests shows the following:—Clinker 2.05, shale 2.50, and coke 1.25.

In each of these separating methods the breeze is screened out from the material before it is passed on to the separating apparatus proper.

The systems usually employed in Britain operate on the flotation principle. One of these is the froth-flotation method. The principle of operation here is as follows: When certain reagents are added in small quantities to water, and the whole is agitated violently, a large number of minute air bubbles is formed. On allowing the liquid to stand, the bubbles do not coalesce, but remain separated from each other and rise slowly to the surface, where a more or less permanent froth is formed. The reagents which may be used for this purpose are many and various, and include certain oils such as turpentine, soluble organic substances such as creosol, certain alcohols like amylalcohol, and sundry soaps. The proportion of the reagent to the material treated is small, amounting in most cases to a fraction of a pound of the reagent to a ton of water.

If solid particles are suspended in the water, they may or may not become attached to the bubbles. If they do become attached, on allowing the liquid to stand, the bubbles rise to the surface and form an extremely stable froth, by which the solid particles are supported. Particles of coal can readily be floated by this method, while, on the other hand, ash and earthy substances will not be floated. It follows then that coal may be separated from its incombustible constituents. This froth-flotation method has already demonstrated its efficiency as a separator of combustibles and incombustibles.

In the Waller washer, water is oscillated by compressed air, and a screen plate upon which the material is deposited is also oscillated by eccentrics from which the plate is suspended, so arranged that, with the downward motion of the plate, the water is forced upwards through the bed of coke and ash. This action separates the coke from the waste, the coke being carried forward by the stream of water, while the clinker and ash remain on the screen plate and fall through the holes to the bottom of the tank.

The Blackett washer, as will be seen from fig. 1, consists of a cylinder to the interior periphery of which is attached a coil made in the form of an Archimedean screw. The cylinder is at a slight incline, the inlet being at the higher end, and rotates at a speed of about nine r.p.m. The screw is arranged to operate in opposition to the incline, so that a heavy material like clinker, thrown in at either end, is taken up by the screw and discharged at the higher end. When the Blackett machine is operating, the cylinder is rotated by friction gear, while at the same time a stream of water is injected at the upper end. The water, flowing over each successive weir formed by the screw, runs away at the lower end. The coke floats on the surface of the water, flows over the weirs, and is discharged at the lower end of the cylinder. The heavy clinker sinks to the bottom and is conveyed by the screw to the higher end of the cylinder, where it also is discharged. In this way clinker and coke, or shale and coke, are separated.

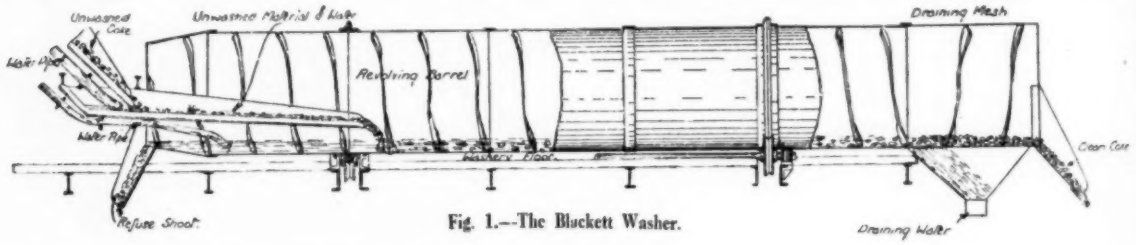


Fig. 1.—The Blackett Washer.

A study of fig. 2 will readily assist engineers to comprehend the simple principle upon which the Columbus separator operates. The machine consists essentially of two main sections: a revolving drum sieve, into which the waste material is fed, either by hand in small machines or by a continuous conveyor in the larger types, and the separator proper. The process is briefly as follows: The material is passed through a revolving small-mesh sieve drum, which rejects the fine dust, and through a revolving large-mesh grid, which ejects any occasional oversize lumps of slag, the elimination of which experience has proved to be desirable, as they consist mainly of pure slag of no calorific value. From the grid the material drops into the separator chamber, consisting of an inclined sheet-iron container within which revolves.

in separate chambers, two superimposed conveyor worms. The container is half-full of water, the specific gravity of which has been increased to about 25 deg. or 30 deg. Beaumé, by any of the numerous means readily available, such as, for instance, by admixture of common clay, loam, chalk, carbide-slime, salt-lye, or any similar suitable substance. Upon falling into this liquid the heavy slag immediately sinks to the bottom, while

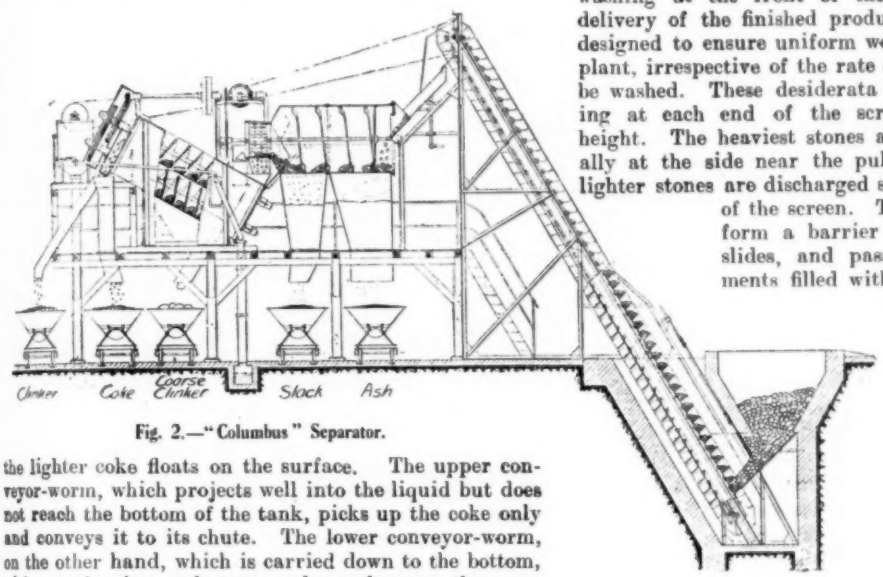


Fig. 2.—"Columbus" Separator.

the lighter coke floats on the surface. The upper conveyor-worm, which projects well into the liquid but does not reach the bottom of the tank, picks up the coke only and conveys it to its chute. The lower conveyor-worm, on the other hand, which is carried down to the bottom, picks up the slag and stones only, and passes them out through a separate chute. Tip wagons, into which the separated coke and slag fall, are usually placed directly underneath these chutes. Large installations are generally arranged to feed the separated materials into railway wagons or into bunkers either directly by mounting the apparatus on a raised platform or by means of conveyors.

The separator requires very little power, *i.e.*, from 1 to 4 h.p., according to size and output. The water consumption is only about 20-50 gallons per hour, and almost any waste water, fresh or salt, can be used. Both the coke and the slag are immediately available for use; the coke, having become only superficially moistened, can at once be re-fed into the furnace. The slag is frequently used for the manufacture of slag-bricks, after being crushed and mixed with a small proportion of sand and cement. These bricks are easy to make, inexpensive and, requiring no firing, can be prepared on the actual site on which they are required. One unskilled labourer only is required to attend the machine, even for the largest type. In big installations additional labour is, however, required to transport the material to and from the machine, or elevators and conveyors can be arranged for this purpose. The smaller types can be mounted on a trolley, so that they may be moved from place to place or up to the existing slag

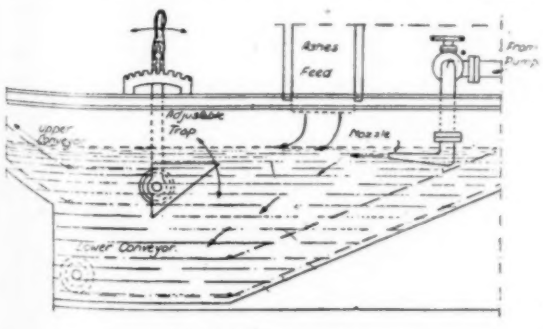


Fig. 3.—Water Separator.

heap. The standard machine is supplied with an overhead shaft fitted with fast and loose pulleys for belt-drive from any convenient shafting. When required, an independent drive by a small electric motor or petrol engine, fitted inside the base of the machine, is arranged for. In this case a small counter-shaft is fitted to a bracket on the side of the machine.

A separator recently developed in Belgium is of the pulsating piston type, in which a single screen is spaced away from both the front and rear walls of the body of the washer; and its object is to introduce into these washers improvements, for the purpose of securing the regular discharge of the lighter pieces or stones (for re-washing at the front of the screen, and a regular delivery of the finished products. The washer is also designed to ensure uniform working and output of the plant, irrespective of the rate of feed of the material to be washed. These desiderata are obtained by providing at each end of the screen a slide of adjustable height. The heaviest stones are discharged automatically at the side near the pulsating plunger; and the lighter stones are discharged similarly at the other side of the screen. These two classes of stones form a barrier in front of each of the slides, and pass into separate compartments filled with water to the same level as that of the water in the screen compartment, so that the washer will never run dry. The finished material is discharged over the barrier of lighter stones. The heavy stones (final stones) being thus discharged on entering the washer, the following conditions are established for the latter: A more homogeneous washing bed, a more uniform water-stroke, and an improved yield.

Since the slides extend across the full width of the washer, there is no longer a risk of the washer becoming obstructed by the presence of a foreign body. The screenings, *i.e.*, the material passing through the screen, are discharged at the bottom of the washer by way of a pipe connection. The lightest stones (for re-washing) are discharged at the front end of the screen by means

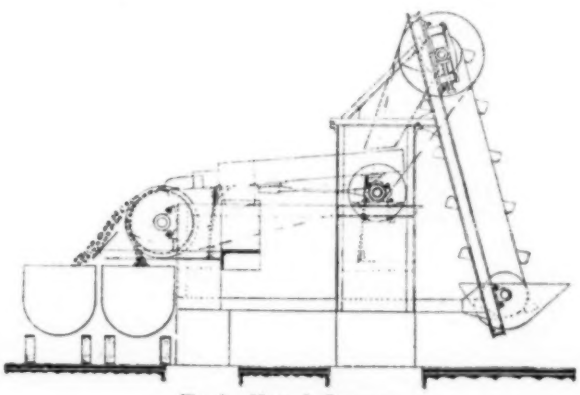


Fig. 4.—Magnetic Separator.

of a slide, identical with that at the rear end, and by a pipe and a bucket elevator. Since the products are discharged into separate compartments, also filled with water to the same level, the washer cannot be emptied of water as in the case of certain other washers.

An interesting German method is that in which the water bath is kept under pressure and in constant motion. The feature of the process is the addition to the water bath of some sand mixed with cement. The porous coke absorbs a little of this mixture, but the coarser pores of the clinker fill up completely with the sand-cement mass, their weight being in consequence considerably increased. The separation of clinker and coke is then readily accomplished by deposition or centrifuging.

An apparatus recently introduced is illustrated in fig. 3, from which the principle will be easily understood. The separation of the combustible matter from

ashes and clinker takes place directly upon the surface of the water before the coke has had time to absorb the latter. This result is obtained by producing upon the water a surface current which draws the lighter material along with it and permits the heavier material to sink, the curves of movement of the two materials being widely separated. The separation is facilitated by a trap, which is mounted horizontally in the current produced by the nozzle-injector, the coke or the other light material falling from the trap upon an upper band-conveyor, while the clinker and heavier material fall upon a lower band-conveyor.

The magnetic process, développed largely in Germany, operates on the principle that all kinds of coal incorporate iron in the form of pyrites. Pyrites has no magnetic properties, but when the coal is burnt, the pyrites is converted into oxides of iron, which are magnetic. Thus in the burnt fuel the combustibles are non-magnetic, and the non-combustible are magnetic. In the Krupp magnetic process the ash is fed on to a brass drum rotating about a horizontal axis, and is exposed to the action of a stationary magnetic field, the strength of which increases from the top of the drum downwards, afterwards decreasing to its least strength in the lower section of the drum (see fig. 4). The screened ashes are fed on to the periphery of the drum, so that the ash constituents containing the iron are held magnetically to the surface for a portion of a revolution, and then fall off into a separate receptable as they pass out of the magnetic field. The coal or coke does not adhere to the drum, but leaves its surface directly after contact with it, and is projected into its own receptacle. It is claimed that lumps of ash and clinker up to 3 in. mesh will adhere to the drum and be removed. The energy required varies from 0.6 to 2.4 kW-hours per ton of ashes treated.

An advantage of the electromagnetic process is the fact that all the combustible matter is recovered in the dry state; thus its value as a fuel is not impaired by a heavy percentage of water.

Rural Electricity Supply in France.

Some Examples of Overhead Line Construction.

By THEODORE RICH.

In France rapid progress is being made with the supply of electricity in rural areas; the demand for labour in some districts seems to exceed the supply, and farmers are beginning to look to electricity to help them to make good the deficiency. The regulations have been framed to aid, not to obstruct, and telephone crossings by pin-insulator lines do not cost £250 each there; if they did, there would be very few roadside lines in existence. It should be remembered that there are thousands of miles of rural lines in districts supplied from steam-power stations.

A poster, reproduced at the end of this article, issued by a firm of contractors in Paris, with a capital of six million francs, which specialises in the erection of lines, transformer posts, and gear generally in rural districts, is of interest as showing that electricity supply under such conditions is no mere fad or passing craze, but a commercial proposition. In the poster can be seen a farmer saying to himself: "Well! We can now get the labour we want by wire." He stands alongside a transformer post, from which a low-pressure line, on wooden poles, devoid of money-wasting so-called safety gadgets, runs to the village near by. In the distance is to be seen an electrically-driven thrashing machine at work.

In order to show that the poster is not merely some of the advertising eyewash so much in vogue to-day, photographs are reproduced of work done by the firm that issues this poster. Fig. 1 shows light steel posts crossing a ploughed field at 15,000 volts, in the departments of Charente and Dordogne. Fig. 2 shows a 15,000-V line alongside the high road in the department of La Vendée. This line has the "Cornez" type of galvanised steel bracket; the bracket is to some extent flexible so as to equalise the strain. If one remembers aright, this class of bracket is made by Messrs. Jacquemard, of La Ricamarie on the Loire, a firm that specialises in the manufacture of standardised steel brackets and ironwork generally for pin-insulator lines.

A span of 40 metres is very usual for wooden pole lines; the conductor is often kept high to allow for trees and bushes. There must be several thousand miles of power lines alongside French roads, yet it is only on exceedingly rare occasions that one hears of accidents to members of the public through their existence.

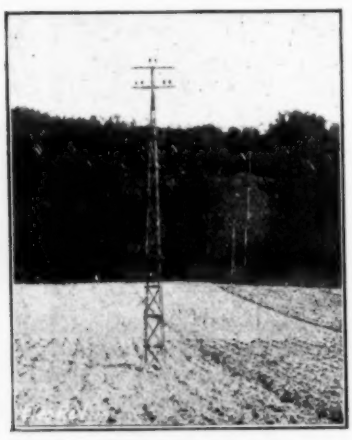


Fig. 1.—15,000-V Steel Pole Line.

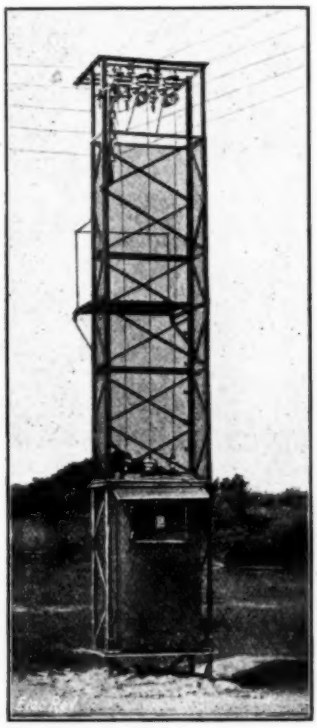
Fig. 2.—15,000-V Roadside Line.

Fig. 3.—15,000-V Concrete Post Line.

Fig. 3 shows a 15,000-volt line with lightened-out concrete poles. These are usually made at some convenient depôt, so far as is possible where suitable aggregate is obtainable, and then shipped to the site, when hard, on motor lorries equipped with trailers arranged like timber or rails on a railway truck.

Some contractors for armoured concrete poles use rapid-setting cement so that the same moulds can be used over and over again without delay. In some cases the bases for concrete poles have been cast round a mould, so that, when hard, the pole itself can be dropped into the socket, wedged up and grouted, a job that only takes a few minutes. Owing to the weight it is, of course, much more easy to get concrete poles on to the site alongside a road than across ploughed fields.

The brackets are of the herring-bone Cornez type, of galvanised steel, and the three phase wires are arranged symmetrically. By this means, should it prove desirable, the phases can be easily transposed to



Figs. 4 & 5.—Steel Transformer Posts.

neutralise any inductive effect on neighbouring telegraph and telephone lines. In fig. 3 a telephone line can be seen on the right-hand side of the road. Judging by the miles and miles of road where power lines are to be seen on one side of a road, and post office lines on the other, these administrations seem to rub along together somehow.

It is interesting that there is no earth wire on many lines in France. In some districts it is found desirable, in other districts not; but it is usual to have them on lines of genuinely extra-high-pressure, say, 45,000 volts and upwards. In the U.S.A. it still seems to be a moot question regarding lowish pressure lines. Our Board of Trade, in times past, with its vast experience, knew more about the matter than the rest of the world combined, and insisted on an earth wire.

Fig. 8 shows a railway crossing with steel supports, at 15,000 volts. As a rule for these, doubled insulators and doubled conductors are used, and, where possible, a reduced span. Earthing guards can be seen on the near side, to earth a conductor if it breaks. French railway companies have found that it is futile to put up over their telegraph, telephone, and signal control wires elaborate guarding arrangements which so often, when loaded with snow in a gale, have a lower factor of safety than the conductor they are supposed to catch if broken. The Post Office officials in France have apparently also learned the same lesson. Only in very rare instances are telephone or telegraph wires put underground at crossings, and yet the French post office engineers have far more experience in such matters than their English *confrères*.

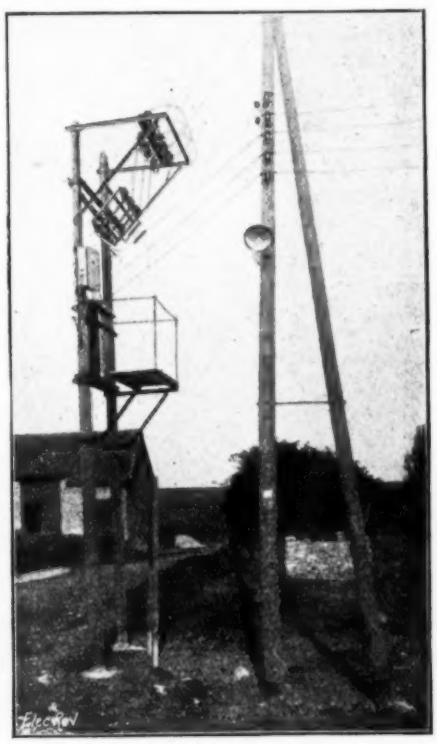


Fig. 6.—Transformer Posts.

Transformer Posts.

An angle-steel transformer post, 15,000/220/380 volts, is shown in fig. 4, of a type suitable for villages. The transformer is in the cabin below. The three pots seen on the top of the frame are the water and glycerine

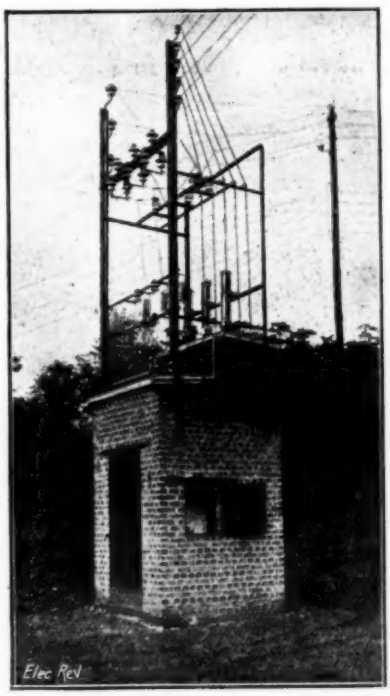


Fig. 7.—Transformer Cabin.

Fig. 8.—Railway Crossing.

resistances in series with the horn arresters. After opening a low-pressure switch accessible through the little door below, leaving nothing circulating but the magnetising current, the high-pressure links can be opened in safety. In fig. 5 is seen a somewhat similar

post without dischargers, but with links, choking coils, and transformer below as before. Concrete is filled in round the base. The making of such steel cabins has become quite a business.

Fig. 9.—A French Poster.

A transformer post with a brickwork cabin is shown in fig. 7 for 15,000/220/380 volts. This class of construction is useful where transformers of 25 to 50 kW are used. Through the open shutter an l.p. meter can be seen. It is possible to arrange for some local handy man to keep the keys of this low-voltage side, so that a fuse could be replaced or even the low-pressure supply cut off pending the arrival of a skilled operative.

A farm transformer post for 15,000/110/190 volts is shown in fig. 6, quite simple and effective.

In France during the last 18 months for some of the more scattered villages a low-pressure network of 200/300 volts, in lieu of the usual 110/190 volts, has been developed, care being taken to have a higher class of low-voltage wiring in the houses to suit the case. The engineers of the different rural authorities have not, apparently, opposed the development.

15,000 Volts as Rural Pressure.

There is an idea prevalent that something like 3,300 volts (following perhaps the old American 2,200-volt system) is a desirable voltage for rural distribution. In wind-swept Flanders 15,000 volts has been in use since before the war. The extra cost per mile of line for insulators is very small; there is but little difference in the cost of transformers and switchgear, and with 15,000 volts, as the capacity for the same percentage drop is as the square of the voltage, about 20 times as much power can be carried as with 3,000 volts. In the North of France, to supply some farms and hamlets, iron wire has been used in some places at this voltage, with two wires single-phase off three-phase mains pending the development of the load. The writer is greatly indebted to the manager of the French company L'Electrification Industrielle for the above photographs of pole lines and transformer posts, and for permission to reproduce its interesting poster.

Modern Electric Cookers.

A Review of the Recent Improvements in Electric Cooking Stoves.

(*Continued from page* 767.)

Probably the most interesting departure from the usual construction of the electric cooking stove is found in the introduction of the table cooker. It is said that in the United States the electric table cooker is an even more popular item in the culinary equipment of the household than is the gas ring in Great Britain. The low oven to which the cook has to stoop each time she gives it her attention still predominates in this country, probably because the available space and the general structure in the majority of houses will not, on the whole, permit of another design. Our attention has been drawn to several designs of this type of cooker; we illustrated the No. 42 "Jackson" table cooking stove in our issue of April 24th last. In this model, it may be recalled, the makers have mounted the oven and hob of one of their ordinary cookers side by side upon a steel table, a ledge underneath the table affording convenient storage for cooking utensils, &c. This apparatus represents fairly the general trend in such introductions. Fig. 4 shows a particularly interesting design. It is a kitchen outfit manufactured by the Arora Company, and consists of an oven mounted on a 13-in. metal stand; beside this combination are three boiling plates and a grill mounted on a sheet-metal table at a suitable height. The whole suggests a very convenient equipment for cooking operations. Fig. 5 shows an "Xcel" cooking range constructed on the same principle, which incorporates another advantage in this type of cooker, in that it permits the provision of a hot cupboard over the oven in the usual position of the hob plate, and so utilises any heat rising from the oven which would otherwise be wasted. The table cooking feature has also been introduced into the "Universal" range of Messrs. L. G. Hawkins & Co., Ltd. This is a

Fig. 4.—Table Cooking Outfit.

very effective and attractive oven and boiler combination, equipped with a damper, aluminium broiler pan and nickel plated wire racks. The total maximum wattage is 6,500 W, and the floor space dimensions are 27 by 43½ in. The crated weight is 320 lb.

Without a doubt the greatest strides made in the improvement of electric cookers have been in connection with the construction of the heating elements and

Fig. 5.—Typical Table Cooker.

in the methods adopted for their housing. The weakest point of any cooker at the present time is admittedly the boiling ring, and it is here that most of the difference of opinion as to the best construction lies. A 40 per cent. efficiency boiling plate represents a good standard. The boiling plates now generally adopted are the outcome of either or both of two schools of thought. One represents the enclosed boiling ring in which the elements are entirely covered as a protection against spilt liquids, &c.; the other represents the open type, which has the advantage that radiant heat is transmitted direct from the elements to the cooking receptacle, but also the disadvantage that the elements are exposed to the liquors, &c., which, it seems inevitable, boil over from time to time. Much is to be said

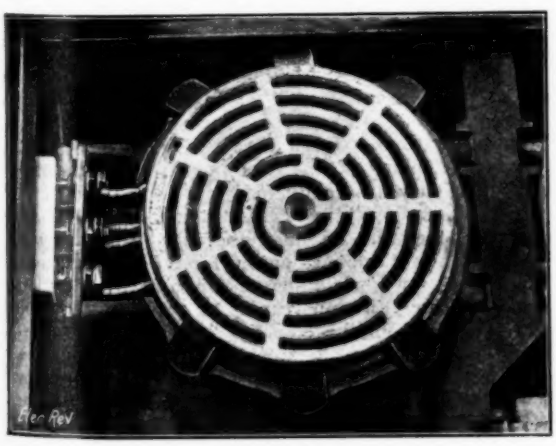


Fig. 6.—Open Plate.

for and against each case. In the enclosed type, of course, some heat is sacrificed for the sake of protection to the elements. One pattern favours efficiency as far as consumption is concerned, while in the other case the main attention is given to the question of efficiency in the direction of maintenance. Which gives the higher combined or total efficiency has probably yet to be proved. Another deciding factor is the consideration of the rate at which the boiling temperature is reached at the vital parts of the plate. It appears to be necessary to sacrifice to some degree the efficiency as regards rapid boiling time in favour of the constant temperature efficiency. The boiling plate of the "Xcel" cookers of the Automatic Telephone Manufacturing Co. is of the open type, the makers being desirous of obtaining the highest efficiency possible from the point of view of consumption. It consists of a fireclay circular slab 7 in. in diameter, with deep grooves retaining high-grade nickel-chrome spirals which are held in position by a special construction. The makers claim that

Fig. 7.—Fully-Protected Plate.

a considerable reduction of heat wastage results from the use of the circular plate. The slab is well perforated to provide for vessels boiling over, and is held in place by a novel cast-iron support provided with three plug-in terminals which engage with special sockets mounted on the side of the cooker; this is an important and interesting feature, it being desirous to have an element or element unit which can be easily replaced. As in several other well-known makes, the entire boiling plate is built in a frame so that it can be instantly removed for cleaning or repairing operations. The adjustment is simple, and the face of the

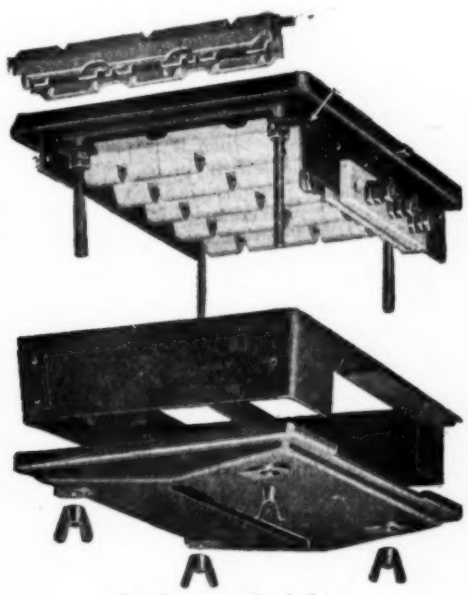


Fig. 8.—Semi-enclosed Plate.

plate is flush with the top of the hob plate. Fig. 6 shows the construction of the "Xcel" open plate. The average loading for the plates of this make is 1,500 W. In the "Universal" cookers, considerable improvement has been made on the enclosed type of boiling ring which, the makers claim, has resulted in a particularly efficient plate of that type. Fig. 7 illustrates the special construction of this boiler unit, which is claimed to prevent warping and cracking.

The element is wound on porcelain formers very near to the inner surface of the cast-iron protecting plate. An asbestos disk is placed immediately under the element, and beneath this is a thick insulating block. The steel casing underneath accommodates these, and the whole is clamped together by a central bolt. It seems that the Jackson Electric Stove Co., Ltd. has sought the happy mean with regard to the boiling plates on its latest cookers. The makers have adopted a semi-enclosed plate, which they claim carries the combined advantages of both the open and closed types. Radiant heat is distributed through slots in the top of the unit, while the elements are protected by bars or closed portions, immediately under which they are installed. Each boiling plate is arranged as a whole unit in an iron box, which can be lifted from the top of the hob complete. The box consists of the top slotted slab and the element container which is bolted to it by means of four bolts and wing nuts. The container holds six elements, two groups of three in series, in parallel. The element coils are wound on clay formers, and are so arranged that new coils can be easily wound. The formers are easily lifted out. The element connections are arranged by means of terminals attached to the inside of the frame or container. It is interesting to note that the complete boiling-plate units and also the separate elements in this design are interchangeable throughout 14 sizes of cookers with varying capacities for cooking for from 2 to 14 persons, also that the clay formers for the elements for all sizes are built up from standard sections upon which the individual element spirals are wound. Fig. 8 illustrates the construction of the "Jackson" plate, but we understand that this is about to be superseded by an improved one, also of the semi-enclosed pattern.

Metro-Vick Supplies, Ltd., is another firm which has adopted the semi-enclosed pattern of boiling plate. The coils are neatly and effectively protected from the unavoidable overflow of liquids, which have a free access through the plate on to the vitreous enamelled crown plate underneath. The protecting bars are of a special non-scaling and non-warping alloy. It is claimed that the watts rating per square inch can be raised to a very high figure ensuring a quick operation and a very high efficiency for this type of plate. The plate installed in the "Cosmos" cooker is made up as a separate circular unit, which is "slipped" into place in the hob plate, and it can be removed by simply lifting it out after disconnecting the leading-in wires. A simple adjusting arrangement is provided for regulating the level of the plates in relation to the hob. The boiling unit is made in two sizes, 8 in. and 6 in. in diameter, and the standard "Cosmos" cooker is provided with one of each size. Each is controlled by a 3-heat switch, for which the elements are suitably wired.

(To be continued.)

When Salesmen Sell the Business.

By A COST CONSULTANT.

There can be little need to emphasise the important place that the selling organisation now holds in modern industry. For many years the selling staff has always been large in certain trades, as, for instance, the garment industry, where the cost of selling is said to be greater than the cost of production, and it would now appear that in many other industries the staff required and the expenditure necessary in order to sell the product are steadily increasing. Very few goods now find their own market, or sell themselves, as it is said. The sales of everything have to be "pushed," either by attractive advertising, capable and persuasive salesmanship, or else by offering some inducement in the form of advantageous prices. When it is proposed to introduce some new article, either in competition with, or to save the expense of some article already on the market, its merit alone will avail its manufacturers little. They must perforce rely upon the skill and originality of their selling organisation to establish their innovation as a popular necessity. Innumerable articles in everyday use, which are regarded as indispensable to 20th Century civilisation would never be used at all had it not been for skilful advertising and selling in the first place; for who would now be without their fountain pen, their safety razor, their Fairisle jumper, or even their wireless?

It is this third weapon of the salesman that it is proposed to discuss in this article, namely, some inducement in the form of advantageous prices. There was a time when prices could be definitely fixed by the manufacturers at their own offices, and their products could only be bought at those prices. This has now become impossible in a large number of cases, and the final fixing of the price has often to be entrusted to the selling staff, with the result that the increased activities of the salesmen have been accompanied by increased responsibilities. It is, however, open to question whether the abuses to which this plant is subject are always guarded against as carefully as is necessary.

The principal charge of the sales staff is, of course, Turnover. It rests almost entirely in their hands to obtain orders for the firm. The whole livelihood of the sales staff depends on turnover, for their commission is based on it; but so does the prosperity of the whole firm, for without an adequate turnover, that is, without sufficient orders, of what avail are the men and machines in the factory? No wonder the entire sales staff, from the sales manager down to the youngest traveller, think and dream of little else but turnover, and regard it as the be-all and end-all of business. No wonder they are inclined to believe that nothing else but turnover really matters very much, and that everything should be sacrificed to attain that end. Some sales managers, in whose charge the final settling of the contract price now rests, are known to contend that even the price must be subservient to turnover. In fact, such is the point of view and the result of the whole training of a salesman, that he is unable to regard any of his responsibilities as greater than, or even as great as, that of obtaining an increased turnover.

Having regard to this outlook on business, it would appear doubtful whether it is wise to give the sales staff too free a hand as regards the price, without taking ample precautions. These are times when many businesses, particularly in the iron and steel trade, openly admit that they are bound to accept work "below the cost of production" in order to keep their staff and workmen together. It must, therefore, frequently be the experience of salesmen acting for firms in this trade to negotiate for work, and sometimes offer reductions without having an opportunity of referring to their head office, and finally to accept work at these reduced prices, even though they know that the firm's original quotation was already below the cost of production. It may at first sight appear strange that any firm can go on accepting orders and carrying out contracts at prices below the cost of production, without either dipping into its reserves, or else heading for the bankruptcy court. Nevertheless, it is being done quite regularly, and it is interesting to examine how such a course can be possible. The explanation is simply this. Every firm has certain establishment charges to meet. They may either be spread over a few orders at a high price, or else absorbed by a larger number of orders at a lower price, and it is the latter alternative which is the only possible one for some firms at the present time.

The broad connection between price and turnover made use of in this explanation is well known and understood, even by salesmen, and it sounds quite simple until it becomes necessary to examine it more closely and to attempt to express in figures the exact price level that corresponds to each rate of turnover. It is profitable to delve beneath the surface and try to find out what this relation is.

It stands to reason, in the first place, that if the price obtained for an order does not recompense the manufacturer for the material he has to buy for the purpose, he will do better to refuse the order. If it does not also pay the wages of the men he has to employ to carry it through, the same remark applies. Besides this the price must also make some contribution towards the establishment charges of the firm, but how much, in order that the order may be worth booking, is not so obvious.

An examination of the items of establishment charges will show that they are divisible into two groups. There is one group including the rent, rates, taxes of the factory, the salaries of the engineers and designers, the works manager's and the foremen's salaries, the cost of keeping the buildings in good repair, and a number of other items which have to be paid for in order to keep the factory in a fit state to accept work. But they will vary very little whether the business has one or a hundred orders in progress. These are known as standing charges. Then there is a group of expenses, such as power, light, small tools, grease, oil, repairs to machines, health and unemployment insurance, the new pensions' scheme, storekeeping, and so on. None of these are incurred until and unless work is being done in the shops. They are known as running expenses.

The running expenses are actually out-of-pocket expenses, in exactly the same way as the material and the wages, so that if the price will not also cover the running expenses, the order is better left alone. But the standing charges have to be paid by the manufacturer whether any orders are obtained or not. The fact that the shops must be ready to carry out orders as soon as received necessitates these expenses, and any contribution towards them will be better, from the manufacturer's point of view, than having to pay them himself.

Any order, therefore, at a price which covers material, wages, and running charges, and contributes something towards standing charges, is better than no order at all. This critical figure at which it begins to be worth a manufacturer's while to book orders is always extremely difficult to estimate accurately, and quite impossible without accurate and reliable costs. At the same time, it does seem most desirable that this critical figure should be worked out, especially for contracts which it is known beforehand are not likely to be let, except at a figure below the cost of production. It would also seem desirable that a salesman, if he has authority to cut prices, should be told this critical figure, as well as the price estimated and quoted by his firm.

Admittedly this is a difficult figure to calculate, and one which cannot be calculated at all without a thorough knowledge of accurate costs, but these are times when orders are difficult to obtain, and in certain trades impossible to book except at figures approaching this critical level, below which it can pay no firm to go. It is, therefore, not only a wise precaution, but a necessity for every manufacturer to provide himself with a method of working out his costs, capable of arriving at this critical figure with a degree of accuracy that can be relied upon.

Only this week one hears of a certain contract for cast-iron pipes, which a well-organised and up-to-date firm calculated could be made for 26s. per cwt., being the total cost of production, and 18s. per cwt. as the bed-rock figure below which it would be better without the order. The order was refused to this firm at 18s. per cwt., because its price was much too high!

Examples such as this, of which many can be cited, make it difficult to believe that firms really know their costs of production accurately, or even realise that there is a limiting figure below which it cannot pay them under any circumstances to cut their prices further. Is the reason of this wild price-cutting (for it is nothing else) simply that salesmen are given too free a hand as regards the price, with the result that they sometimes cut below the economic limit without knowing it, or is it the more serious possibility, that many manufacturers do not know where this limit lies?

In trades where prices below the cost of production are so frequently quoted that they are the rule rather than the exception, too much attention cannot be paid to the calculation of accurate costs (or if it is new work, to estimates based upon accurate costs) so as to be able to find this economic limit. In such circumstances, too, the anxiety of salesmen to increase turnover must be curbed. They should be informed what this limit is, on every contract where there is a possibility of their having to offer a lower price, and warned never to offer or accept a price which is below the economic limit.

Shop-Window Lighting.

Scientific versus Haphazard Methods.

By A. V. HYDE.

The factor that will influence business even more greatly in the future than it has done in the past is the proper illumination of the shop-window. There is a great deal of work to be done by the trade in this important division of lighting. The direct influence for good of scientific illumination upon turnover was proved long ago, and there is not a retailer in any of the variety of trades where goods are sold over the counter, who, if he would keep abreast of competition and see a constantly expanding business, can afford for a moment to ignore the question of correct and adequate light in the window. The average shop-keeper in other trades will dress his window—well, ill, or indifferently—and, after a fashion, light his window also. But, unless he has the benefit of expert advice, the installation will perform only a fraction of its true function—which is to sell the goods—and will fall far short of what it might have been. He must be convinced of the value of light in the window, before he is actually sold an installation.

The field for the further development of creative shop-window lighting is so great and so important from the point of view of revenue to the electrical trade, that the dealer and the contractor must decide upon some way of approach to the individual, rather than wait for the buyer to come to them.

Just as the private buyer will not be interested in the technical description of an electric fire, or an electric cooker, until he is persuaded of the *need* for it, it is not the description of a system of shop-window lighting that the shopkeeper wants so much as in the first place a conviction of its benefits. The rest will follow in due course, for the arguments that can be adduced in favour of modern ideals in window lighting cannot fail to impress any reasonably-minded and progressive retailer. It may be clarifying to see what these arguments are, and to have them at hand for use at any time. Let us call them "The case for more and better shop-window illumination," and list them as follows:—

1. Light is a never-failing source of attraction: to the public it is as the candle to the moth.

2. After sunset one of the favourite pastimes of the public is to "go and look at the shops."

3. People buy where the light is bright.

4. Anything bright is always cheering and stimulating: a well-lighted window puts the passer-by in a cheerful frame of mind. He is then receptive to suggestion and impression. He is in the mood to feel the "desire to possess"; that is a sale half-made.

5. Light, in that it draws the crowds to the window, and a percentage of the crowds inside, is a salesman.

6. It is a salesman that knows no regular hours of working. It will work from dusk to bedtime, and any time during the daylight hours that it is required, for the cost of the energy consumed. It is a silent salesman

Fig. 1.—A typical Shop-window Reflector.

that is worth ten extra ordinary salesmen inside, because it appeals to potential buyers in the place where they are most numerous—in the street.

7. It will work hours after the business is closed—the days when the business of the day had to cease when the shutters were put up are past, thanks to the boon of scientific window illumination. It is in the power of efficient window lighting to make subtle impressions for the morrow.

8. The public, because of the attraction of a centre of bright light to the individual, tends to memorise windows which have attracted it, and to look for the same windows again. Thus light creates goodwill and builds for the future.

9. Correct and sufficient light on the goods adds attractiveness and value to even the best-dressed window. It gives an impression of cleanliness, neatness, and enterprise, to the least discriminating shopper.

10. Window lighting is every whit as much salesmanship as window dressing. Be the selling effort ever so intense, it falls short of maximum productivity if it ignores the potentialities of the window as a creator of business.

11. The finest advertisement for efficient shop-window lighting and the best proof of all the claims made for it, is the use that is made of it by all the leading retail departmental stores, and by hundreds of retailers in various parts of the country. The best salesman for light is light itself.

Present-day shop-window lighting is based partly upon the avoidance of glare, the hiding of the light source, and the concentration of a maximum amount of light diffused upon the display. When the light source is visible, the eye is distracted from the main object and much of the value is lost.

One system of shop-window lighting that has been very widely installed is the "Gecoray" system, which has the reflector principle as a basis. The source of the light is hidden from exterior view by what is known as "top-lighting," by the installation of specially-designed reflectors (fig. 1), hidden by a valance or "pelmet," and placed in the front of the window ceiling. This system provides for the illumination of every size of shop-window—the small, the average, and the high and shallow window. The lamps for which each reflector is designed vary in power according to the space to be illuminated. The system can be adapted to any existing structural contour or type of window decoration, and to cover any area. It is installed quickly and easily, and brings no dislocation of business in the process of installation. It is economical to install and maintain. It includes, as part of the complete system, spotlights for throwing a concentrated beam of light upon any special feature in the window display, and floodlights for the floodlighting of an entire display. Coloured light in the window is in every way the equal of spotlighting and floodlighting; in some cases it may have greater value. Colour lighting has been proved to attract even larger crowds to a display than when ordinary methods of illumination are used. A colour screen equipment is included in this system, red, orange, green, and blue screens being provided for the reflector. A typical example of the use of the system is illustrated in fig. 2.

Fig. 2.—An Example of good Window Lighting.

With this description of a popular system, the reader will have received, we hope, some idea of the elements of scientific shop-window illumination, as it is in use to-day, and be in a position to pass over such information to the prospect who comes to him, or whom he himself approaches.

The importance of the trade helping itself towards obtaining the business that is to be done in this branch of more and better lighting is second only to the necessity for a full all-round appreciation of the great opportunities that exist. The fact that they do exist is all to the good of the electrical industry, and it is in the power of one and all to share in the business thus presented.

An Italian Peat-Operated Power Station.—In view of the high cost of coal in Italy, owing to the fact that this fuel has to be imported, much attention has within the past few years been devoted to methods of utilising the deposits of peat which abound in certain parts of the country, for the generation of electrical energy. One of the most recent and important installations of the kind is that which has been established at Torre del Lago, near Lucques, by the Società Torbiere d'Italia. From *Industria* we learn that the peat is treated in Mond-type gas producers, the gas being utilised for firing the boilers which supply steam for the turbo-generators. The peat is obtained from a deposit on the banks of Lake Massaciuccoli, where it is estimated that no fewer than 12 million tons are available. The peat, when extracted, contains as much as 85 per cent. of water; it is first allowed to dry in the open air until the humidity falls to about 35 per cent. The air-dried peat is then loaded into barges and transported to the gasification plant about 1¼ miles away. At present six gas producers are in operation, but a further two sets are being added. Each of the producers is capable of gasifying three tons of peat per hour under normal conditions, and four tons per hour when accelerated. When the whole eight sets are in operation it is expected that the plant will yield about 1,412,000 cu. ft. of gas per hour under normal conditions, and about 2,118,000 cu. ft. per hour when accelerated to meet the peak load demands. The gas is piped direct from the scrubbers to the eight Tosi vertical-tube boilers, no gas holder being employed as a measure of economy in installation cost. The electrical plant in which the gas is utilised will eventually consist of three sets of 5,000-kW turbo-generators producing 16⅔-period alternating current at 4,000 volts, 1,000 r.p.m. At present two generating sets are in operation, the output being utilised for traction purposes on the Spezzia-Pisa-Leghorn and Pisa-Florence electric railways. It is estimated that when fully completed the Torre del Lago installation will be able to supply 30 million kWh and produce by-products to the extent of 5,000 tons of tar and an equal quantity of sulphate of ammonia per year.

Electricity Supply in Great Britain.—VI.

Hampshire and the Isle of Wight.

No part of Hampshire has yet been included in an Electricity District, nor up to the present has the County been affected in any way by the Acts of Power Companies.

There are six Local Authorities owning electricity undertakings (excluding the Bournemouth Corporation, which is only authorised to supply for public purposes) and nine Company undertakers, whose areas of supply lie wholly or partly within the County.

COMPANIES.

Aldershot Gas, Water and District Lighting Co.
Andover & District Electricity Co., Ltd.
Bournemouth & Poole Electricity Supply Co., Ltd.
Gosport & Alverstoke Electric Lighting Co., Ltd.
Hindhead & District Electric Light Co., Ltd.
Lymington Electric Light & Power Co., Ltd.
Milford-on-Sea Electric Supply Co., Ltd.
Ringwood Electric Supply Co., Ltd.
York Town & Blackwater Gas Co.

Electricity Supply in the Counties of Hampshire and the Isle of Wight.

The following is the list:—

LOCAL AUTHORITIES.

Aldershot Corporation.
Basingstoke Corporation.
Fareham Urban District Council.
Portsmouth Corporation.
Southampton Corporation.
Winchester Corporation.

The number of units sold annually per head of population in any particular County is not always readily ascertainable, and the method to be used for estimating it is becoming somewhat complicated.

An undertaker who sells in bulk to another undertaker situated in a different County, as Portsmouth Corporation does to Chichester Corporation, is a typical example of the difficulty referred to above. The simplest way is to deduct the number of units sold in

bulk, which means in the case quoted that the County of Hampshire does not get any credit for supplying the energy (neglecting losses) bought by Chichester from Portsmouth.

Again, in the case of an undertaker like the York Town and Blackwater Gas Company, whose area of supply extends into Berkshire and Surrey, it would require a considerable amount of work to allocate the number of units sold per County (assuming that there are plenty of consumers all over the area in each of the three Counties), whilst the "kudos" for supplying the energy in this instance should really belong to the War Office. It should, however, be noted that the output of each of the undertakings owned by the Bournemouth and Poole Electricity Supply Co., Ltd., the Southampton Corporation, and the Portsmouth Corporation, respectively, is rapidly increasing.

With regard to the remaining undertakers, it has been estimated that the total number of units sold by these is less than half the total number of units used for traction at Bournemouth, Southampton and Portsmouth.

The map on the previous page is reproduced from the 1917 Boundary Commission map of Hampshire (by permission of the Controller of H.M. Stationery Office); a list of the topographical alterations since 1917 is added below to bring the map up to date.

The hatched parts which cover about one-third of the total area of Hampshire indicate that statutory powers for the supply of electricity are held or have been applied for in respect of them, leaving the remaining two-thirds of the county to be added to our list of "unoccupied areas." The 1921 Census gives the following particulars for the Administrative County of Hampshire and Associated County Boroughs:—

Acres.	Persons.	Resident families.	Buildings not containing dwellings.
958,896	910,252	206,274	11,220

(1) The Urban District of Aldershot has been created the Borough of Aldershot.

(2) The Urban District of Gosport and Alverstoke has been created the Borough of Gosport.

(3) In 1920 part of the Parish of Cosham was added to the Borough and Parish of Portsmouth.

(4) In 1921 the Parish of Cosham was re-named the Parish of Widley.

(5) The boundary between the Parishes of Headley and Grayshott has been altered.

(6) Part of the Parish of Hound has been transferred to the Parish of Hamble.

(7) The Urban District and Parish of Fleet have been enlarged by the inclusion of part of the Parish of Elvetham.

(8) and (9) The following were added to the Borough of Southampton in 1920:—The Urban District of Itchen, the Parish of Bitterne, and parts of the Parishes of North Stoneham and South Stoneham. The added parts of North Stoneham and South Stoneham Parishes were amalgamated to form the Parish of Saint Nicholas; and the part of South Stoneham not added to Southampton was merged into the Parish of West End. In April, 1925, the Parishes of Southampton, Itchen, Bitterne, and Saint Nicholas were united to form the new Parish of Southampton co-extensive with the County Borough.

Isle of Wight.

The 1921 Census gives the following particulars for the Administrative County of the Isle of Wight:—

Acres.	Persons.	Resident families.	Buildings not containing dwellings.
94,146	94,666	21,308	1,776

The Isle of Wight Electric Light and Power Co., Ltd., and the St. Helens (I.W.) Electric Lighting Co., Ltd., hold statutory powers in respect of all the Boroughs and Urban Districts and part of the Rural District. An application has been lodged by the Isle of Wight E.L. and P. Co., Ltd., to obtain statutory powers over the remaining part of the Rural District of the Isle of Wight, hence the whole of the County is shown hatched. In 1923 part of the Parish of Northwood was added to the Urban District and Parish of Cowes.

Radio Wave-Lengths.

Some Comments and Suggestions.

By W. MOON.

LISTENERS who live near the sea often find it difficult to hear a foreign station owing to ships signalling on the same wave-length as the station. It is therefore advisable to limit both ships and broadcasting stations to certain wave-lengths, or ranges of wave-lengths, so that neither of these forms of transmission shall interfere with the other.

Also in selecting wave-lengths for different stations it is advisable that none of them should be multiples by 3, 5, or 7 of those of other stations, so that harmonics of a near station shall not jam a more distant station.

Now that broadcasting has reached such proportions, it would be interesting to know to what percentage of selectivity the average listener can adjust his apparatus, and also what percentage of selectivity can be obtained as a practical proposition. While the apparatus of the average listener can perhaps select wave-lengths differing by 2 or 3 per cent. when they are of equal strengths, it is too often found that a near powerful station will jam a weak distant station when the difference between their wave-lengths is as much as 10 per cent.

When selecting the wave-length of a particular station reference should be made to a list in which the wave-lengths are arranged in geometrical proportion, so that the wave-lengths can be equally spaced as regards interference with each other.

If 1 to 10, or 10 to 100, or 100 to 1,000, and so on, be divided into 100 geometrical parts, each number will be 1.023293 times its predecessor. In the following list 1 to 10, &c., are divided into 100 geometrical parts, the decimal points being omitted. The numbers are given to four places of figures.

Referring to this list, it will be observed that, while there is duplication of stations on certain wave-lengths, there are other ranges of wave-lengths that are not used. But no doubt the committee now dealing with this matter will arrange to space out the stations evenly, so that there is the least possible clashing in wave-lengths between broadcasting stations; and also that a range of wave-lengths, say, 600 to 1,000 metres, shall be reserved for ships' signalling alone:—

Wavelengths in Geometrical Proportion to four places of figure.

1000	Moscow 1000	3243	Nottingham 324
1023		3311	Hull 335; Bremen 330
1047	Vossegat 1050	3389	Plymouth 338; Blumendaal 332
1072	Norddeich 1088	3467	Bradford 346; Nuremberg 340
1097	Brussels 1100	3548	Cardiff 353; Pic du Midi 350
1122		3630	London 365
1148	Kbely 1150	3715	
1175		3802	Manchester 378; WGY (U.S.A.) 379
1202	Ryvang 1190		
1230		3890	Bournemouth 386; Madrid 392
1259		3981	Newcastle 400; Hamburg 395
1288		4074	WOR (U.S.A.) 405; Munster 410; Haelsinkki 405
1318			
1346		4169	Glasgow 422; Breslau 418
1380		4266	Rome 425
1413	Moscow 1410	4365	Belfast 439; Stockholm 440
1446		4467	Stuttgart 443
1479		4571	Leipzig 454
1514	Toulouse 1525	4677	Frankfort 470
1549		4786	Birmingham 479; Swansea 482
1585	Daventry 1600	4898	Aberdeen 495; WEAF (U.S.A.) 491
1622			
1660			Munich 485
1698		5012	Berlin 505
1738		5129	Zurich 515
1778	Radio-Paris 1780	5248	Vienna 530
1820	Komarov 1800; Nauen 18050	5370	
1862		5483	
1905		5624	
1950		5754	
1995	Amsterdam 2000	5889	
2042		6026	
2094	Amsterdam 2100	6166	
2143		6310	
2193		6457	Milan 650
2239		6607	
2291		6761	
2344		6918	Graz 692
2399	Monsant 2450	7080	Gothenberg 700
2460	Koenigswusterhausen 2460	7244	
2512		7413	
2570		7586	
2630	Brussels 265; Eiffel Tower 2650	7763	
2692	Malmoe 270	7943	
2754		8128	
2818		8318	
2877	Cassel 288	8511	Lausanne 850
2951	Dresden 292 Hanover 296; Koenigswusterhausen 2960	8710	
		8913	
		9120	
3020	Sheffield 301; Stoke-on-Trent 306	9333	
3090	Leeds 310; KDKA (U.S.A.) 309	9550	Budapesth 950
3162	Liverpool 315	9772	

The Electro-Deposition of Cadmium and its Alloys.

Some Notes on the Processes Employed and the Results obtained.

By E. W. LEWIS.

METALS are now deposited by electrolytic processes on a commercial scale, large quantities of metals being produced for the various industries. Electrolytic deposition processes are also employed for covering the more easily corroded metals with films of metals which offer greater resistance to atmospheric conditions and are of a more permanent character, suffering much less oxidation. Some of these processes have found extensive commercial application, cadmium electrolytic deposits being used as the outer resistant film, as it offers protection to iron and steel surfaces, the properties of the cadmium film being intermediate between the metals zinc and nickel. The high resistance of cadmium to chemical action, compared with zinc, renders it suitable where zinc fails or is unsatisfactory; wire and wire ropes are cadmium-coated for resisting sea-water activity and corrosion, also for coating battery terminals and connections for primary and secondary batteries. The field of the electrolytic deposition of cadmium shows promise of considerable expansion.

The electrolytic deposition of the metals follows Faraday's laws of chemical equivalerts, the ampere-hour being associated with the electrolytic deposition of a definite maximum amount of metal, which is only realised under the optimum conditions. With an insoluble anode a definite minimum e.m.f. is required to maintain electrolysis. In the case of the electrolytic deposition of cadmium, it has been found that the best results are obtained when the amount of metal deposited per ampere-hour approaches the theoretical, the deposit being white, firmly adherent, finely crystalline, and withstanding burnishing. When the amount of metal falls much below the theoretical, hydrogen gas becomes occluded, and forms crevices in the deposit, leading to a loose and often powdery film and rendering the product unsuitable for commercial purposes. Defective deposition may also be due to excessive current, or to simultaneously deposited hydrogen due to a weak electrolyte or to the deposition of basic cadmium compounds. With an efficient anode solution and a good conducting electrolyte, a p.d. of about 0.4 to 0.6 volt, will maintain a fair rate of cadmium deposition. The electrolytic deposition of cadmium is readily carried out under the same conditions as in the case of zinc. The *Chemical Trade Journal*, August 1st, 1924, states that Borcher found that current densities of 60 to 100 amperes per square metre yielded a good and useful deposit of cadmium. In America, cadmium plating is now being introduced under the patent name "Udylite," and it is found to protect iron and steel against sea-water or atmospheric corrosion in a far superior manner to hot or cold galvanising.

Electrolytically deposited cadmium forms a highly efficient protective covering for aluminium, the difficulties due to the porosity of the commercial aluminium metal having now been overcome by the application of sand-blasting. The aluminium surface is initially sand-blasted, coated with a thin film of iron, again sand-blasted, and then placed in the cadmium bath consisting of either cadmium sulphate and potassium cyanide or cadmium ammonium sulphate and a small percentage of peptone; electrolysis is carried out at 20 deg. C., using cadmium cast anodes, and a current density of 5 to 7 amperes per square foot. The "burning" of cadmium deposits is considerably lessened by the presence of substances in the electrolyte, which exert a solvent action on the basic compounds of cadmium; colloidal substances such as glue or gelatine are highly effective in this respect. Cadmium deposits take well on all metals, no "strike" solutions or intermediate coats being essential; they are superior to those of zinc for many purposes, due to the cadmium being more resistant to chemical action than zinc. Cadmium-plated aluminium has been subjected to the very severe "salt spray" and "water line" tests, with highly satisfactory results; perhaps the only derogatory feature acting against cadmium-coated aluminium is its increased weight. Cadmium-coated steel is becoming of first-rate importance; it gives a hard and pleasing surface, the final heat treatment causing the two metals to form an alloy on the surface. In commercial cadmium electroplating, close adhesion and compactness are of prime importance in order to obtain an article of good finish and receptive of a high polish.

PHYSICAL PROPERTIES OF CADMIUM AND CADMIUM DEPOSITS.

Atomic radius	1.6 angstroms
Atomic volume	12.9
Coefficient of expansion ...	.0000306 at 0—100 deg. C.
Melting point	320 deg. C.
Specific resistance	6.2 to 7.0 microhm per cm. at 0 deg. C.
Specific heat	.05669
Temperature coefficient of resistance	424 at 0—100 deg. C.
Tensile strength	13,660 lb. per sq. inch
Elongation	44 per cent.
Thermal conductivity ...	0.22 gramme-calorie per cu. metre per degree per sec.
Electrochemical equivalent...	2.0955 grms. per amp. hr.
Boiling point	778 deg. C.

Electro-deposited cadmium takes a high polish and is highly resistant to tarnishing when exposed to atmospheric conditions. The colour of electro-deposited cadmium approaches that of silver, but it retains its polish without tarnishing longer than silver or silver alloys. It is superior to tin as a rust-proof agent for iron and steel.

Electro-deposition of Cadmium from Cyanide Solutions.

The electrolyte used for commercial cadmium deposition usually consists of a complex solution of cadmium carbonate in a potassium cyanide solution. The cadmium content may vary from 8 to 40 grammes per litre, with an excess of 5 per cent. of potassium cyanide. The anodes generally consist of pure cadmium, operated at an e.m.f. of 3 volts, and the solution is maintained at a temperature of 35 deg. C. Blaset (*Metal Industry*, January, 1912, p. 13) maintains that freshly precipitated cadmium carbonate should be used, as it gives better results; it is prepared by precipitating the cadmium sulphate with sodium carbonate and washing out the sodium sulphate by decantation, the cadmium carbonate being insoluble. The following quantities are suggested:—

Cadmium sulphate, 2 oz.
Potassium cyanide, 5 oz.
Water, 1 gallon.

All the metal is derived from the anode, which consists of pure cadmium sticks suspended in the electrolyte. The cyanide should be occasionally replenished by the addition of small quantities of cyanide solution. The electrolysis may be conducted in the cold at about 2 volts.

The Udylite Co., U.S.A., has recently patented a process for the cadmium electro-coating of steel and iron articles, edged tools, piano wires, and clock and watch springs, rendering them rust proof. According to the details given in the patent specification, the cadmium is electroplated on to the articles, which are then heat-treated and polished, an iron-cadmium alloy being produced on the surface. The bath used contains a 2.5 per

cent. solution of cadmium, prepared by dissolving the cadmium sulphate in water, just precipitating with caustic soda and re-dissolving in potassium cyanide solution, avoiding excess. The anode is pure cadmium, and a current density of 7 amperes per square foot is used. After deposition, the plated article is immersed in lime and heated at 250 deg. C. for four hours, a treatment which hardens the surface by forming a cadmium alloy, giving a highly desirable and superior surface.

Electro-deposition from Other Solutions.

Mathers and Marble (*Trans.*, Amer. Elect. Chem. Soc., 1914, Vol. 25, p. 297) claim that the properties which are peculiar to cyanide solutions of being able to give smooth cadmium deposits are due to the partial decomposition of the cyanide during electrolysis, forming colloidal substances which function as "additive" agents preventing the formation of rough crystalline deposits. The *rôle* of these "additive" agents has been but little studied, but they appear to play a very important part in electrolytic deposition processes.

Plating with solutions of cadmium other than in cyanides requires the addition of colloidal substances in order to produce a good deposit. The following solution has been found to give tolerable results in cadmium coating: 4 per cent. cadmium sulphate in 4 per cent. fluosilicic acid and 0.1 per cent. peptone at a current density of 3.6 amperes per square foot. Another electrolyte is 4 per cent. cadmium perchlorate in 7 per cent. perchloric acid, with 0.1 per cent. peptone; it gives a bright smooth deposit. Fluoborates or fluorides may also be used, substituting for peptone glue or clove oil.

Cowper-Coles (J.S.C.I., 1904, p. 446) states that cadmium-silver alloys have been deposited on a commercial scale, an alloy containing a small percentage of silver having been employed for coating the bright steel parts of machines, whilst domestic articles have been plated with a cadmium alloy containing 7.5 per cent. silver. Such alloys have been found to withstand tarnishing much better than pure silver or standard silver containing 7.5 per cent. of copper. Very careful adjustment of the concentration of the solutions and the current densities seems to be necessary in order to obtain a definite composition of the electro-deposited alloys, and, moreover, if the bath is to be maintained for any length of time in working condition, the anode must be of the same composition as the deposit required. Any change in composition of the deposit during electrolysis is immediately reflected in its colour and general appearance, both properties being excellent guides to the skilled and experienced operator. Budgen maintains that for every composition of the electrolyte, there is a definite current density to be used so as to produce a good and regular deposit. The ratio of the cadmium and silver in solution is dependent on the density of the solution, different proportions of the two metals being necessary if the solution is very dense. It is, however, desirable to use a strong solution, because a greater current density can be employed, and consequently the alloy can be deposited more quickly. The stirring of the solution permits the use of still higher current densities, but the proportion of the metal must be adjusted accordingly.

REFERENCES TO CADMIUM ELECTRO-PLATING.

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2. Blasset. *Metal Industry*. Jan., 1912, p. 13.
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4. Desch. *Chem. Trade Journal*. 1924, p. 536.
5. Fischer. *Chem. Zeitung*. 1904, p. 1209.
6. Ingalls. *Metallurgy of Cadmium*. 1906, p. 594.
7. Knok. *Metal Industry* (New York). Vol. XVIII, p. 556.
8. Rideal. *Electro-Metallurgy*.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

Correction.—We regret that owing to an error in the preparation of the advertisement of the Qualitas Electric Co., Ltd., appearing on Supplement 19, the address of the company is incorrectly given. For Dashwood House, please read Fulwood House.

Anglo-German Trade.—A conference to discuss questions as to the interpretation and effect of certain provisions of the Anglo-German Treaty of Commerce and Navigation was commenced at the offices of the Board of Trade on November 9th.

Increasing the Lighting Load.—The Ohio Public Service Co. has by an intensive "home-lighting" campaign increased its annual revenue per customer by 20.6 per cent. According to the *Electrical World*, it was found that the average wattage used for lighting in consumers' kitchens was 50. It was calculated that a 150-W lamp in a suitable fitting was necessary to give adequate, glareless illumination. Assuming that the lamp in the kitchen was "on" for 1,000 hours—a conservative figure—it appeared that there was scope for the sale of an average of 100 kWh more to consumers. On this basis the increase in the net revenue was calculated at $7 per customer annually. By an intensive "drive," an enormous number of kitchen-lighting units were sold—over 14,000. The company next turned its attention to outlets and table lamps, and then to the improvement of the lighting in various rooms. In these directions more than 10,000 improved lighting fixtures were disposed of, most of which required larger lamps than had been previously used. Finally, the company conducted a "re-lamping" campaign, inducing the customers to fill all empty sockets and replace lamps of inadequate wattage. This, in four months, resulted in the sale of the equivalent of 2,000 kW of lamps.

The British Industries Fair.—Visitors to the British Industries Fair next February will again have the privilege of travelling to and from London or Birmingham at the cost of the single fare and one-third. The concession is the more valuable as there are none of the usual restrictions as to trains or time.

It is reported that the Air Ministry has purchased the buildings and 179 acres of land at Castle Bromwich (where the Fair is held) for £60,000. The place is to be used as an aerodrome—its original purpose.

The Fair authorities state that a large number of applications for space in the London section have been received from radio apparatus manufacturers, and it is hoped to have a very representative display of this equipment. It is further stated that the Fair has the wholehearted support of the National Association of Radio Manufacturers and Traders.

British Empire Exhibition.—The decision to voluntarily wind up the British Empire Exhibition was confirmed at a meeting of the Association held last week, and Mr. J. H. Thomas, Sir J. A. Cooper, and Sir A. E. Whinney, were appointed joint liquidators.

Unemployment Insurance Inquiry.—The Minister of Labour has appointed a committee "to consider, in the light of experience gained in the working of the Unemployment Insurance scheme, what changes in the scheme, if any, ought to be made." The following are the members of the Committee:—Lord Blanesburgh, G.B.E. (chairman), Sir Hugo Hirst, Bart. (chairman and managing director of the General Electric Co., Ltd.), Sir Glynn Hamilton West (chairman of Sir W. G. Armstrong, Whitworth & Co., Ltd.), Miss Margaret Bondfield, Sir James Curtis, K.B.E., Prof. Carless Davis, C.B.E., Mr. J. Hamilton, Mr. Frank Hodges, Mr. A. Holmes, Mr. Laurence Holt, Sir James Lithgow, Bart., Sir William McLintock, K.B.E., and Viscountess Milner. The secretary is Mr. J. A. Dale, of the Ministry of Labour, Queen Anne's Chambers, Broadway, S.W.1

Chinese Notes.—A number of cotton-ginning firms in Hanyang intend to install electrical machinery when the Hanyang electrical plant, now in course of erection, is completed.

The Yen Ming Electric Light Co. is being formed at Kutang, Kiangsu province, with a capital of $10,000.

Radio Traders' Associations.—The Bombay Presidency Radio Traders' Association is the name of a new body lately formed in India to protect the interest of the trade as well as to foster an interest amongst the public for radio by co-operating in making the broadcast programmes more interesting and also by conducting suitable propaganda. Increasing business is being done in wireless apparatus throughout Australia. The New South Wales Electrical Employers' Federation (radio section) which has almost every trader on its membership list, is appointing a high-salaried publicity manager, who is being given full authority to establish offices, and an efficient staff at an early date. His mission will be to "boost" broadcasting among the public, to supply daily and country papers with news on wireless subjects, and to benefit the radio trade in general. By an amendment to the Post and Telegraph Act which recently came into operation in New Zealand, dealers in radio equipment are required to take out a licence with the Minister of Telegraphs and to keep a full record of all sales and the names and addresses of purchasers. Power is given to revoke licences and the penalty for a breach of the provision is a sum not exceeding £50.

The E.L.M.A. Bureau at Glasgow.—At the Scottish Electric Lighting Service Bureau, Glasgow, on November 12th, Mr. H. E. Hughes, district engineer, gave an interesting demonstration and lecture to ladies. He pointed out that it was in Glasgow that Lord Kelvin lighted the first house with electricity, but said that Britain was now strangely far behind America and the Continent in the use of electrical appliances. The difficulty was to make people use light correctly. Examples were given of correct lighting installations for shops and the home.

Lead.—Reporting on November 14th, Messrs. James Forster & Co. stated:—"The present high price of lead, in our opinion, is entirely due to the support afforded to this market by the American position and, should conditions become easier again in that country, it would be quickly reflected in a lower price here." The Board of Trade returns for October were:—Imports, 25,758 tons; exports, 2,676 tons; leaving for home consumption, 23,082 tons.

Trade Announcements.—Mr. A. B. BLAKEY, A.M.I.E.E., electrical engineer and manufacturers' agent, informs us that his telephone number is "Midland (Birmingham) 3737."

MESSRS. P. ADAIR, LTD., of London, have opened a branch office and stores at 30a, Change Alley, Sheffield, in charge of Mr. A. Walkington, of Nottingham. Stocks of lamps, cables, &c., are carried. Telephone number: "5151 Central."

MESSRS. HEUGHAN & GILMOUR, electrical and mechanical engineers, 79, Grant Road, Wellington, N.Z., require agencies for manufacturers of high-class electrical goods. They ask f r catalogues and shipping particulars.

The registered office of the BRITISH ALUMINIUM CO., LTD., is now: Adelaide House, King William Street, London, E.C.4.

MESSRS. ROBINSON & HANDS ELECTRICAL CO., LTD., of Birmingham, have opened an office and stores at Station Road, Taunton, Somerset, for trade in the West of England. Supplies are available for electrical contractors and radio dealers. Telephone No.: "495 Taunton."

MESSRS. MAY & PADMORE, LTD., have appointed Messrs. Markes, Ward & Co., Ltd., 30, High Street, Islington, N.1, as their sole electrical agents in London and district for "Maymore" electric fires and heating apparatus, &c., of which they are holding a stock.

MESSRS. ELECTRICAL DEVICES, LTD., have opened new offices, stores and showrooms for extension purposes at Powdene House, Pudding Chare, Newcastle-on-Tyne.

THE LONDON ELECTRIC STORES, LTD., has moved to 9, St. Martin's Street, Leicester Square, London, W.C.2. Telephone No.: "Regent 7545."

Catalogues and Lists.—THE MIDLAND ACCUMULATOR CO., LTD., 47, Newhall Hill Parade, Birmingham.—A leaflet containing descriptions and prices of high-pressure accumulator batteries for radio work.

AUTOMATIC & ELECTRIC FURNACES, LTD., 173-175, Farringdon Road, E.C.1.—Catalogue Section C, describing the company's electrically-heated carburising furnaces. Illustrated.

MESSRS. SMITH & ANSELL, Stockfield Works, Acocks Green, Birmingham.—A priced pamphlet illustrating electric lamps of classic design for suspension from a ceiling.

MESSRS. F. A. WILKINSON & PARTNERS, LTD., Gretton, nr. Kettering.—A priced and illustrated leaflet describing automatic high-speed wind dynamos for battery charging.

MESSRS. L. G. HAWKINS & CO., LTD., 30-35, Drury Lane, W.C.2.—A well-illustrated catalogue of ornate domestic electrical appliances.

THE MARCONIPHONE CO., LTD., 210-212, Tottenham Court Road, W.1.—A coloured poster effectively advertising "Mellovox" loud speakers, and a coloured showcard advertising the company's "Ideal" and "Ideal Junior" radio transformers.

MESSRS. R. A. LISTER & CO., LTD., Dursley, Glos.—An illustrated catalogue and price list of the company's electric lighting and power sets.

MESSRS. SYDNEY JONES & CO. (LONDON), LTD., 28, Endell Street, W.C.2.—A trade price list of radio accessories and components.

FULLER'S UNITED ELECTRIC WORKS, LTD., Woodland Works, Chadwell Heath, Essex.—An illustrated booklet dealing with "Sparta" loud speakers, anode supply filters, resistance-capacity and reaction couplings, &c. Priced.

THE WHOLESALE FITTINGS CO., LTD., 23-27, Commercial Street, E.1.—An illustrated and priced catalogue of "Supastone" lighting glassware, together with a supplementary list.

TUNGSRAM ELECTRIC LAMP WORKS (GREAT BRITAIN), LTD., 72, Oxford Street, W.1.—An illustrated folder containing details and prices of the company's vacuum and gasfilled lamps.

RUNBAKEN MAGNETO CO., 270, Deansgate, Manchester.—A "repairs and spares" price sheet, containing particulars of dynamos, parts, &c., for many makes of automobiles.

THE ALBERT & J. M. ANDERSON MFG. CO., 12, Moor Lane, E.C.2.—A leaflet describing self-aligning racks for power and telephone cables.

W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., 11, Holborn Viaduct, E.C.1.—Pamphlet "W.B.A.," advertising "Henley" link disconnecting boxes with teak frames. The prices of frames are given.

HIGGS MOTORS, Witton, Birmingham.—November stock list of d.c. motors and dynamos and a.c. motors.

CAXTON NAME PLATE MANUFACTURING CO., 11, 13, and 15, Rochester Row, S.W.1.—Pamphlets dealing with the firm's name plates and interchangeable stencils.

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, 56, Victoria Street, S.W.1.—November stock list of a.c. motors, and d.c. motors and dynamos.

MESSRS. J. H. TAYLOR & CO., Macaulay Street, Huddersfield.—A comprehensive price list of radio apparatus of all makes.

SIEMENS & ENGLISH ELECTRIC CO., LTD., 39, Upper Thames Street, E.C.4.—November price sheet of electrical materials, appliances, and accessories.

MR. ALAN WRIGHT, Sentinel House, Southampton Row, W.C.1.—A folder containing illustrations, details and prices of "Inventum" electric fires with plug-in elements.

MESSRS. NEWTON & WRIGHT, LTD., 471-3, Hornsey Road, N.19.—A series of illustrated leaflets dealing with apparatus for ultra-violet therapy, and diathermy and X-ray equipment. Priced.

THE MULLARD WIRELESS SERVICE CO., LTD., Nightingale Lane, Balham, S.W.12.—A window poster in subdued colours advertising the "Mullard" radio valve.

Bankruptcy Proceedings.—W. G. CONWAY (LISTRON), wireless component dealer, 88-90, Chancery Lane, W.C.—Receiving order made November 9th on creditor's petition. First meeting November 26th. Public examination January 27th, both at Carey Street, W.C.

S. PURCELL, The Arcade, Goole, Yorks., electrical contractor.—The public examination of this debtor was held recently at the Court House, Wakefield. The statement of affairs showed liabilities of £185, and there was a deficiency of £63. Debtor attributed his failure to bad trade and keen competition. The examination was closed.

W. A. A. C. ROBINSON (W. A. C. Robinson), electrical engineer, 10, Carnaby Street, Golden Square, W.—Application for discharge to be heard November 24th at Carey Street, W.C.

GRIFFITHS & HUGHES, electricians, Whitcombe Street, Aberdare.—Receiving order made November 6th on creditor's petition.

V. REED, electrical engineer, 10, Chapel Road, Eastville, Bristol.—First meeting November 18th at the Official Receiver's offices, 26, Baldwin Street, Bristol. Public examination November 27th at the Guildhall, Bristol.

G. F. NEAL, electrical engineer, 5, Smallgate, Beccles.—Trustee, Mr. H. P. Gould, Official Receiver, 8, Upper King Street, Norwich, released November 9th.

J. WILSON, electrical engineer, late of 70, Ebrington Street, Plymouth.—First meeting November 19th at 11, St. Aubyn Street, Devonport. Public examination December 18th at the Western Law Courts, Guildhall, Plymouth.

J. R. CHARNOCK, cycle dealer and electrical engineer, late of 6, Stonegate Road, Leeds.—Re-opening of public examination November 24th at the Court House, Leeds.

C. F. LINDOP (C. F. Lindop & Co.), electrician, late of 62, Dale Street, Liverpool, now of 135, Lark Hill Lane, Liverpool.—Bankrupt's discharge granted subject to consenting to judgment being entered against him by the Official Receiver, trustee, for the sum of £25.

G. A. MORLEY (A. Whale & Co.), electrician and wireless engineer, 201, Powis Street, Woolwich.—Trustee, Mr. T. Gourlay, Official Receiver, 29, Russell Square, W.C., released November 2nd.

L. PRIDAY, plumber and electrician, 20-22, Somers Road, Southsea, Hants.—Trustee, Mr. C. Hoult, Official Receiver, 87, High Street, Portsmouth, released November 2nd.

M. BREINGAN, electrical manufacturers' agent, 57, Robertson Street, Glasgow.—Meeting of creditors November 23rd at the Faculty Hall, St. George's Place, Glasgow. Agent, Mr. A. E. Paterson, 180, Hope Street, Glasgow.

S. H. BARDWELL, trading as Bennett, Bardwell & Co., 22, Church Street, Basingstoke, electrical engineer.—The public examination was held at the Winchester Bankruptcy Court on November 10th. The statement of affairs showed ranking liabilities of £616 and net assets valued at £266, leaving a deficiency of £350. Debtor attributed his failure to competition in business and heavy private expenses. The examination was concluded.

Company Liquidations.—A. C. ALEXANDRA & CO., LTD.—Mr. G. D. Pepys, Official Receiver, in a report shows that the total deficiency as regards creditors and contributories was £17,888. Mr. A. C. Alexandra offered a sum of £4,000 for the goodwill (if any) of the company, to procure the annulment of bankruptcy proceedings, and in settlement of all claims against him in the bankruptcy and liquidations, but Mr. Pepys states that only £600 has been received and this amount (of which a part is claimed by his trustee in bankruptcy) will be insufficient to pay the preferential creditors in full.

MIDDLETON ELECTRIC TRACTION CO., LTD.—Particulars of claims to the liquidators, Mr. T. Bower and Mr. T. H. Underhill, 88, Kingsway, W.C., by December 31st.

DIAMOND WIRELESS, LTD.—A meeting of members is called for December 14th, at 442, Strand, W.C., to hear an account of the winding up from the liquidator, Mr. A. Hart.

Deed of Assignment.—P. R. ANDREWS, electrician, Town Green, Wymondham.—Particulars of claims were to be sent to the trustee, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C., by November 19th.

Dissolution of Partnership.—A. M. YOUNG & CO., manufacturers of radio components and accessories and capstan press products, 52, Bordesley Street, Birmingham.—Mr. J. R. Whitehill and Mr. H. D. Kirk have dissolved partnership. Debts will be attended to by Mr. Kirk, who will continue the business under the same style.

Private Arrangements.—R. L. Johnson, electrician, 239, Rake Lane, Wallasey.—A meeting of creditors was held recently at Liverpool. A statement of affairs was submitted which disclosed liabilities of £405. The assets totalled £95, leaving a deficiency of £310. It was reported that the debtor commenced business at Seacombe about two years ago, with £40 capital. No books of account had been kept, with the exception of a day book, but it appeared that the turnover had been between £650 and £700 for the period. The debtor attributed his position to lack of capital and heavy expenses. It was decided that the deed of assignment already executed in favour of Mr. Parkin S. Booth should be confirmed. A committee of inspection was also appointed, consisting of a representative of the General Electric Co., Ltd., and Mr. John Airey. The following are creditors:—

	£		£
Electric Components Co., Ltd. ...	60	General Electric Co., Ltd. ...	210
Eaton, S., & Sons	30	Welsbach Light Co.	35
Electrolier Co.	25		

Peter Curtis, Ltd., 75a, Camden Road, N.W., manufacturing electrical and radio engineers.—A meeting of creditors was held on November 16th, when a statement was presented showing a deficiency. An offer of 4s. in the £ was made and accepted. Further details will appear in our next issue.

Book Notices.—"Molesworth's Pocket Book of Engineering Formulæ," 29th Edition. London: E. & F. N. Spon, Ltd. Price 6s.—This revised and enlarged edition contains a wealth of information concerning almost every branch of engineering. Commencing with many useful mathematical and mensuration tables, including the many conversion tables which are required at the least expected moments, it proceeds through data of every description, physical, chemical, &c., to the advanced calculus of engineering, civil, mechanical and electrical. Numerous tables of squares, cubes, powers and roots, reciprocals and logarithms, and also specially prepared tables for assistance in ascertaining the circumferences and areas of circles, &c., are included. The steam and hydraulic formulæ are another feature. In the electrical portion a brief explanation is given of most of the electrical terms. Of particular help to the electrical engineer should be the general information and tables concerning conductors and transmission lines and cables. Useful extracts from the I.E.E. regulations will no doubt prove a valuable addition. Several connection diagrams are also given. The contents are fully indexed.

"*Journal* and Record of Transactions of the Junior Institution of Engineers." Vol. XXXVI. Part II. November, 1925. Price, 2s.

"Memoirs of the College of Science, Kyoto Imperial University."—Series A, Vol. VIII, Nos. 5 and 6. August, 1925. Series A, Vol. IX, No. 1, July, 1925; No. 2, August, 1925.

"Transformers for Single and Multiphase Currents," by G. Kapp, revised by R. O. Kapp.—Third Edition. Pp. xi + 391; figs. 229. London: Sir Isaac Pitman & Sons, Ltd. Price, 15s. net.

"Scientific Papers of the U.S.A. Bureau of Standards."—Vol. 20, No. 512; 10 cents.

"Technologic Papers of the U.S.A. Bureau of Standards."—Vol. XIX, Nos. 291 and 293, 25 cents each; No. 294, 10 cents.

"Miscellaneous Publications of the U.S.A. Bureau of Standards."—No. 64, 15 cents.

German Activity in India.—The Berlin correspondent of the Exchange Telegraph Co. states that, following the example of the Siemens concern, the A.E.G. has established a branch in India at Bombay under the name Havero Trading Co. (A.E.G. Department). The Bergmann Electro-Works Co. also proposes to establish an Indian branch.—*Financial News.*

New Swiss Company.—A new company has lately been formed in Berne (22, Spitalgasse) under the style of the Gesellschaft für Radiotechnik, to manufacture radio apparatus.

Transport Cost Reduction.—In the course of a paper which he read recently before a meeting of the Wholesale Produce Merchants' Association, Mr. C. Holmes Waghorn, general manager of Walker Vehicles, Ltd., stated that most wholesale distributors of produce spent from 2 to 5 per cent. of their turnover on transport and delivery charges. It was therefore a sound principle to discover what means of carriage was best suited to each class of distribution. Nine-tenths of the tonnage in produce road-haulage in this country was intensive, *i.e.*, was borne on routes 20 or 30 miles in length with frequent stops. This demanded road vehicles of the largest possible carrying capacity commensurate with the smallest street encumbrance, and the highest possible manœuvring and convenience factors. In the author's opinion the latest developments of the electric vehicle afforded a solution. Although the maintenance of the petrol vehicle was a considerable item, in its own sphere—over distances of between 30 and 60 miles—the petrol lorry was irreplaceable. The economic field of the steam vehicle was now generally understood to be confined to loads of over 10 tons on journeys not requiring long loading or delivery stops or encountering excessive traffic density. The use of horses was on the wane, although for very frequent stops the horse was worth its keep. Only one form of vehicle really met the requirements of intensive transport—the electric vehicle. The author then briefly outlined the virtues of the battery vehicle, mentioning its reliability, ease of control, cleanliness, economy, &c. With modern types of accumulators little trouble was experienced and numerous charging facilities were available. As a proof that the electric vehicle was satisfactory in service Mr. Waghorn quoted the names of firms which employed it extensively.

Turbine Construction in Norway.—Some time ago great indignation was caused in Norway on account of the Government authorities having placed orders with a German firm for turbines for the State hydro-electric works at the Nore, because the German prices were considerably lower than those quoted by Norwegian engineering works. Now that two further turbines are required for the same power station the directors of the Water Power Department have unanimously resolved to recommend the acceptance of Norwegian tenders for the execution of the work, and this proposal has been adopted by the State Labour Department, which has decided that the turbines shall be made by the A.S. Kvaerner Bruk and the A.S. Myrens Verksted as joint contractors.

The French Electrical Market.—The United States Commercial Attaché in Paris, in the course of a recent report, stated that the demand in France for electrical equipment continued strong, with factories receiving a good volume of orders. Prices of electrical apparatus had, however, risen, and the same was the case with industrial machinery.

Russian Foreign Orders.—*Reuter's* representative recently interviewed M. Frumkin, Soviet Assistant Commissary for Foreign Trade, who during the past month has been visiting Berlin, Paris and London, with a view to inspecting the activities of Russian Trade Organisations in those cities and ascertaining the conditions for placing orders, chiefly for machinery, in this country and elsewhere. M. Frumkin said that orders would shortly be placed abroad for machinery for, *inter alia*, the oil, coal-mining, metallurgical, engineering, electrical, timber, paper-making, and chemical industries. The general impression he had gathered was that of the three countries France could offer very favourable conditions on account of her depreciated currency, and machinery could be got there very cheaply. "Germany," said M. Frumkin, "gives us much more favourable terms than Great Britain and, from a technical point of view, is very highly developed. It is, however, in my opinion of great importance that we should have our machinery from Great Britain and we are very keen on getting old British machinery replaced by new. . . . The whole amount at present in view to be spent in Great Britain is about £15,000,000, and for this and other orders we only want the same credit conditions as apply to other countries, such as France, Italy, Germany, Czecho-Slovakia, &c." M. Frumkin referred to the fact that the whole trade turnover with Great Britain had been raised from £15,000,000 in 1922 to £49,000,000 in the present financial year, and it was hoped that, owing to a good harvest and the general economic progress, this trade in the following year would be increased by about 80 per cent.

New French Company.—A new company has lately been formed in Paris (54, Rue de la Boetie) with a capital of 150,000 fr. and the title La Société de l'Energie Hydro-Electrique du Lot, to establish plant to utilise the water power of the River Lot.

American Co-operation in Building European Power Stations.—It is reported from New York that bankers and industrialists in the United States intend to form a syndicate with a capital of $26,000,000 under the title of the American Utilities Corporation, with the object of co-operating with European interests in the realisation of schemes for the establishment of power stations which have been brought forward in Poland, Czecho-Slovakia, and Roumania.

Keeping in Touch.—In the United States sellers of electrical appliances are realising more and more that an article is not finished with when it is sold. If it goes wrong the customer will most certainly return, but if it continues to give good service, which is generally the case, the sale can still be a link between the seller and the buyer. *Electrical Merchandising* quotes a case in this connection. The Nashville (Tennessee) Railway & Light Co. makes it a part of its selling policy to keep an eye on all electric cookers which it sells. Periodically a letter is sent out to the buyers of these appliances asking a number of questions about the customer's experience with her range. It is asked if any trouble has been experienced, whether the company's service has been found satisfactory, how the cooking compares with that done by other means, &c. The final question is: "Can you recommend the range to your friends?" The company finds that over 80 per cent. of these letters are answered in full, and, upon the average, two and a half new "prospects" are discovered with each answer. This is quite apart from the number of other appliances which are sold to satisfied owners of cookers.

The Committee on Industry and Trade.—It was announced last week that the period allotted by this Committee to the hearing of evidence from trade organisations and other bodies and individuals is drawing to a close. The prefatory memorandum which accompanied the Committee's recent "Survey of Overseas Markets" is being published by the Stationery Office in pamphlet form.

Copper, Lead, and Rubber Prices.—Messrs. F. Smith and Co. report, November 17th: Copper (electrolytic) bars, £68 15s., 10s. inc.; ditto, ditto sheets, no change; ditto, ditto wire rods, £77 10s., 5s. inc.; ditto, ditto h.c. wire, 10d., 1/16d. inc.

Messrs. James & Shakespeare report, November 17th: No change in the prices of copper bars (best selected), sheet and rod; English pig lead, £38, 15s. dec.

Messrs. Ed. Till & Co. report, November 17th: India-rubber, Para fine, 3s. 10d., ¼d. inc.

One Way to Help Export Trade.—The employés of James Pender & Co., Ltd., a subsidiary of the British Empire Steel Corporation, manufacturing nails and wire, in St. John, N.B., have presented the management with a resolution, expressing their willingness to work overtime without pay, in order to permit the company to compete with foreign manufacturers in export markets. Mr. W. F. Knoll, manager of the company, said that a few weeks ago, word came to him that European firms were underbidding Canadian prices to a great extent on account of the low rates of exchange in some of the export fields, and that difficulty was experienced in marketing the products from this country. The matter was discussed at one of the council meetings between the management and employés of the Pender Company, and a suggestion made that if the cost of production were cut sufficiently by free overtime work, the local firm might be able to compete with the foreign manufacturers. The men asked for a few days to consider the proposition, and returned with the announcement that they were prepared to try the experiment, in order to hold the market for the company, and thus keep the wheels turning in the regular hours of work. The provision is made that should any profit accrue from the export business under this arrangement, it will be shared between the company and the employés on a 75-25 per cent. basis, the big end of the division going to the men. It is planned that for a start the men will put in three extra hours every other evening.—*Journal* of the British Empire Chamber of Commerce in the U.S.A.

The "Canning" Trade Mark.—MESSRS. W. CANNING AND CO., LTD., of Birmingham, have been successful in obtaining registration of the name "Canning" as a trade-mark relating to electro-plating, polishing and lacquering machinery, including the necessary equipment and materials. Some of our readers may be unaware that the House of Canning has been established 140 years. In future the name "Canning" will apply solely to goods manufactured by the company.

The Rating of Machinery.—The Government's new Rating and Valuation Bill, which contains provisions respecting the exemption of machinery from rating, which has been contended for by the Machinery Users' Association for many years, stands committed to the consideration stage and third reading in the House of Commons early in the Session which opened on Monday last.

Wages in the Australian Electrical Industry.—From statistics relating to the wages paid to Australian electrical workers during 1924, reproduced in the *Australasian Electrical Times*, it appears that the wages paid to armature winders, instrument makers, cable jointers and fitters, the highest-paid grades, ranged from £5 3s. per week in Perth to £5 15s. in Sydney. The wages of other grades ranged, in general, from £4 17s. in Perth to £5 7s. in Sydney.

For Sale.—Mr. H. J. Shaw will sell by auction on December 1st at 85, Newington Causeway, S.E., a quantity of wireless and electrical goods, &c. Fuller, Horsey, Sons & Cassell will sell by auction on December 2nd, at Church Wharf, Chiswick, electric motors, circuit breakers, and switchgear. (See our advertisement pages to-day.)

American Industrial Activity.—The *Electrical World* states that all authorities agree that the trend of United States business during September was very satisfactory and that the volume of trade this autumn will be perhaps the largest that the country has ever experienced. Several of the primary industries, however, which exert a large influence upon the operations of the electrical industry are still operating below normal. In September the iron and steel industry was operating at 15.2 per cent. and the textile industry at 2.3 per cent. below normal, but practically all primary industries reported increased operations over August. During September the electrical industry as a whole was operating at 4.1 per cent. below the estimated normal for the month. In August it was operating at 5.6 per cent. (revised), and in July at 4.5 per cent. below normal. Incomplete returns indicate that the electric light and power branch of the industry continued the upward swing which started in June and was operating at 2.8 per cent. above normal during September.

The Czecho-Slovakian Electrical Market.—A recent issue of *Commerce Reports* contained a review of the possibilities for the sale of domestic electrical appliances in Czecho-Slovakia. At the outset it is stated that gas is in the ascendancy owing to its cheapness as compared with electricity. Fans, owing to the mild climate, are not extensively used, but such as are found are of German or Italian make. Vacuum cleaners are gradually finding a market in the country; Swedish makes predominate, although German, English, and American patterns are also used. The only article of laundry equipment which sells well is the flat-iron; it is not thought that the market for washing machines is likely to develop. Electric cookers are not used, as the high price of energy prohibits them, but small cooking equipment, such as toasters, percolators, and kettles, are in fair demand; most of these appliances are German. "Headlight" (bowl) heaters are used quite extensively for incidental heating; the most popular appliances of this type are home products, but German heaters are imported. It is believed that the country presents a good potential market for electro-therapeutic appliances. Prague dealers usually buy direct from the foreign manufacturers, but sometimes they obtain goods from European general distributors. The importation of domestic electrical appliances is subject to import permits issued by the Ministry of Commerce; these, it is stated, are freely granted.

The Dunedin Exhibition.—The *Daily Mail* reports that the Dunedin Exhibition, which is one-third the size of Wembley, was opened on Tuesday last. Although an international display, it is almost purely British in character; the British Court provides a magnificent display.

Electricity in Tin Mining.—Speaking at the annual meeting of the Northern Nigeria (Bauchi) Tin Mines, Ltd., last week, the chairman (Mr. G. Temple Harris) said that the outstanding feature in the company's business during the past year was the completion of the Kwall Falls installation. This hydro-electric works was reported to be very successful and doing all that had been asked of it. Mr. A. R. Canning said that the institution of the Kwall Falls scheme opened up a new era for the company. An enormous amount of work had been put into the scheme since its conception nine or ten years ago. The chairman, in reply to a question, said that the production costs would be cheapened by means of the power now available.

The Parsons Plant at Chicago.—The 50,000-kW turbo-alternator and condensing plant for the Crawford Avenue power station of the Commonwealth Edison Co. of Chicago, which was manufactured in the works of Messrs. C. A. Parsons & Co., Ltd., at Heaton, Newcastle-on-Tyne, was shipped to Chicago in August, 1924. The erection was completed and the plant was ready for service on the day of the opening ceremony, May 26th, 1925. We understand that except for slight preliminary adjustments, which in a plant of this description and size are inevitable, the machine has run more or less continuously, carrying its full share of the load of the station. The pre-heaters for this machine have not yet been installed by the Commonwealth Edison Co., and so far no figures as to steam consumption are available.

Japanese Electrical Notes.—The electrification of the Imperial Steel Works, Mawata, Kyushu, is proceeding rapidly.

The Tenryugawa Electric Power Co. (capital 50 million yen) is to erect six power stations, with an aggregate capacity of 150,000 kW, on the Tenryu River. The work is expected to occupy seven years from next May.

The Keihan Electric Railway is doubling its power-station capacity by installing a 5,000-kW set, which has been ordered from a Japanese firm. Preliminary steps are being taken in connection with the erection of a 2,000-kW station by the Sendai municipality.

The Hamana Hydro-Electric Co. has been formed to erect a station to develop 10,000 kW from the Denoyu River, at a cost of 3½ million yen.

An application for permission to install an electric railway between Mishima and Hakone has been filed. A number of other electric railways are projected. One of the most important schemes is that of a group in Kyushu, which has a capital of 2 million yen.

Unemployment.—The total number of persons registered as unemployed on November 2nd was 1,207,700. This was a decrease of 24,696 on the week, and for the first time this year the figure was below that for the equivalent date of last year. During the following week there was a further decrease of 9,512.

Lighting and Power Notes.

Alston.—PROPOSED ELECTRICITY SCHEME.—A committee has been appointed to consider the question of obtaining an electricity supply for the town.

Ayrshire.—YEAR'S WORKING.—We have received from Mr. W. C. Bexon, engineer and general manager, a copy of his report, together with the statement of accounts, on the first year's working (year ended May 15th last) by the Ayrshire Electricity Board, of the Ayr and Kilmarnock electricity undertakings, formerly controlled by the Ayr and Kilmarnock Corporations respectively. The total revenue amounted to £168,968, and the working expenditure was £77,228, leaving a gross profit of £91,740, to which was added a balance from the previous year of £2,203, making a total of £93,990 available. This was disposed of as follows:—Capital and other charges, £88,598; transferred to appropriation account, £2,250; balance, being profit for the year, carried forward, £3,142. The capital expenditure during the year amounted to £148,879, the largest items being £88,598 for mains and £41,776 for machinery. The sales of electrical energy amounted to 25,780,564 kWh, and the average price obtained was 1.573*d.* per kWh. The maximum supply demanded was 12,500 kW. During the year two 50,000-lb. Babcock & Wilcox boilers were installed, and work was commenced on the installation of the second 12,500-kW turbo-alternator. Additional sub-stations were erected, and the number now in the area exceeds 100. Other work completed during the year included the interlinking of the power stations at Greenock, Paisley, and Kilmarnock.

Brandon and Byshottles (Co. Durham).—ELECTRICITY SUPPLY.—The Urban District Council has decided to support the Chamber of Trade in its endeavours to secure electricity for the lighting of private premises, and has also agreed that the surveyor shall obtain for submission to the next meeting of the Works Committee the scale of charges from Newcastle Electric Supply Co. for street lighting.

Bristol.—ELECTRICITY AGREEMENT.—The Electricity Committee has made a further agreement for a bulk supply of electricity to the North Somerset Electric Supply Co., Ltd., which involves the laying of mains and the construction of a sub-station at an estimated cost of £20,703.

ELECTRICITY SCHEME APPROVED.—The Electricity Committee's proposal to erect a new power station at Portishead, details of which were given in the ELECTRICAL REVIEW of October 23rd, p. 665, was passed by the City Council on November 9th. The Committee has already obtained provisional approval from the Electricity Commissioners to the scheme.

Burnley.—"ALL-ELECTRIC" HOUSES.—With a view to encouraging the use of electricity for domestic purposes, the Corporation is to erect four "all-electric" houses for demonstration purposes.

Cannock.—ELECTRICITY EXTENSION.—Mr. S. T. Allen, electrical engineer, has submitted a report to the Electricity and Omnibus Committee showing that the estimated cost of the proposed electricity extensions to Great Wyrley and Cheslyn Hay is £20,785.

Clayton (Yorks.).—ELECTRICITY SUPPLY.—At a recent meeting of the Urban District Council, a deputation reported having interviewed Bradford Corporation Electricity Committee with regard to the proposed supply of electricity to Clayton. The Corporation agreed to adhere to the charges and conditions laid down in an agreement formerly made between the two authorities, and stated that if there was no opposition to its application for an Order, a supply would probably be available within six months.

Continental.—FRANCE.—The Société de l'Energie Electrique de Rouergue, which owns a 6,000-kVA hydro-electric power station on the River Tarn, is preparing to establish a second plant of 32,000-kVA capacity to utilise the Pinet Falls on the same river.

BELGIUM.—According to the report for the year ended June 30th last, the Société d'Electricité de l'Ouest de Belgique, of Brussels, is now supplying electricity to 74 localities, while negotiations for supplying 24 other communal districts are in progress. During the year 168 miles of new h.p. and l.p. mains were laid, bringing the total up to 708 miles. Other work completed during the year includes the establishment of 50,000-V transmission lines between Renaix and Audenarde and between Swevelghem, Vive, and St. Bavon. The company's plant capacity is now 19,510 kW.

Darley Dale.—INQUIRY.—The opposition of the various local authorities and the residents of Darley Dale to the proposal of the Derbyshire and Nottinghamshire Electric Power Co., to erect overhead power cables from Matlock to Darley Dale was the subject of an inquiry on November 5th at Darley Dale by Sir W. F. Marwood. The company applied for wayleaves over property belonging to Mr. T. Wright and the Oaker Trust. The opposition contended that the cables would depreciate the value of that property and would ruin the beauties and amenities of the valley. Mr. A. D. Phillips, general manager of the company, said that the cable would be similar to those which were being erected in all parts of the country. To take the cable underground would cost an additional £1,750. The Ministry of Transport's decision will be announced in due course.

Glasgow.—PROGRESS DURING SEPTEMBER.—During September 107 houses were wired under the Corporation Electricity Department scheme, making the total to date 1,287 and 470 applications for the hire of fires, cookers, time switches and boilers were received, bringing the total to 7,903.

Gretna and Eastriggs.—ELECTRICITY SUPPLY.—The necessary capital (£4,000) has now been subscribed to enable a local company to take over the lighting of the townships of Gretna and Eastriggs from the Government.

Hastings.—LOANS.—The Electricity Committee is applying for sanction to loans of £7,000 for mains and £5,000 for meters.

ELECTRICITY EXTENSIONS.—The Committee is to extend the mains to supply electricity to Baldslow at a cost of £1,300, and to Grove Housing Estate at an estimated cost of £3,538.

Holbeach.—PROPOSED ELECTRICITY SUPPLY.—The Urban District Council has received a communication from the Boston and District Electric Co. inquiring whether the Council would entertain a proposal for a supply of electricity in bulk. The Council has decided to obtain further details of the proposal.

Iceland.—HYDRO-ELECTRIC DEVELOPMENT.—According to the *Board of Trade Journal*, during the last session the Icelandic Alting passed a law dealing with water power concessions. The law gives the right to private persons to exploit waterfalls within their own holdings of land provided that the power of the water-course does not exceed 500 h.p. The Government may grant concessions to Icelandic promoters for the exploitation of waterfalls where the power does not exceed 25,000 h.p. and where the district council in the area waives its right to make use of them. Concessions of 25,000 h.p. or more to foreign subjects and companies may only be granted by special Act of Parliament. Plants of less than 500 h.p. will pay no State charges. All others will pay to the State an annual sum, the minimum of which is 50 ore per h.p., and the maximum for the first twenty-five years 5 kroner per h.p. The Waterfalls Commission of 1917 estimated Iceland's water power at about 4 million h.p., of which practically none has been utilised.

Inverness.—PURCHASE OF UNDERTAKING.—At a meeting of the Town Council on November 9th it was decided to purchase the undertaking of the North of Scotland Electric Light and Power Co., Ltd., and to apply for a Special Order authorising the Council to supply electricity in its area.

King's Lynn.—YEAR'S WORKING.—The report on the working of the Corporation electricity undertaking (engineer, Mr. C. W. Jackson) for the year ended March 31st last, shows a total revenue of £18,725, as compared with £16,625 in the preceding year. Working expenses amounted to £10,454, as against £8,580, leaving a gross profit of £8,271 (£8,046), to which was added a balance of £4,700 from the previous year, making a total of £12,971 available. This was distributed as follows: Contribution to capital expenditure, £4,057; interest and other charges, £5,291; balance carried forward, £3,623. The capital expenditure during the year amounted to £4,718, and the amount now spent on the undertaking stands at £107,381. The sales of electrical energy increased from 1,056,799 to 1,504,665 kWh, and the average price obtained fell from 3.70d. to 2.89d. The maximum supply demanded rose from 873 to 1,102 kW.

New Zealand.—AUCKLAND.—Preparations will shortly be made by the Auckland Electric Power Board to take electricity from the Arapuni hydro-electric power scheme. Under the agreement with the Government the board will take power by April 1st, 1928, and its officers have prepared a report on the works necessary on the change over from steam-generated power. The scheme most favoured provides for current being transmitted at 22,000 V by underground and overhead cables, and the total estimated cost is £238,100.—*Tenders.*

Northern Ireland.—LETTERKENNY (CO. DONEGAL).—The Urban District Council has decided to ask Mr. Macrory, city electrical engineer, Londonderry, to prepare a scheme for the installation of electric lighting in the town.

Special Orders.—Application has been made to the Electricity Commissioners by the Long Eaton Urban District Council for a Special Order authorising it to include in its area of supply the area recently added to the urban district, and the parish of Toton.

The Commissioners have submitted to the Minister of Transport for confirmation, Special Orders made by them authorising the Bethesda Urban District Council to supply electricity in its area, and the Spalding Urban District Council in the urban and rural districts of Spalding.

Stockton-on-Tees.—EXTENSION OF SUPPLY.—The Electricity Committee is to canvass the Ragworth estate with a view to ascertaining the probable number of consumers, prior to taking any further action on the proposed extension of the cable which it is estimated will cost £5,500.

Stretford.—LOAN SANCTIONED.—The Electricity Committee has obtained sanction to borrow £4,925 for the provision of mains.

Sunderland.—WIRING OF SMALL HOUSES.—The Town Council has adopted a scheme submitted by the Electricity Department for installing electric lighting installations in certain houses of three to six rooms. This decision follows the adoption of a street lighting programme for all streets in the borough. The Council will undertake the cost of wiring houses, which is estimated will range from £5 14s. 7d. for a three-roomed house to £9 16s. 2d. for a six-roomed house. The owner or tenant will have the option of purchasing the installation from the Corporation at any time. The charge to tenants for the hire and maintenance of the installation will be 1s. 6d. weekly for the summer quarters, and 2s. weekly for the winter quarters, and electricity will be charged for at the rate of ¾d. per kWh. The initial outlay is not to exceed £8,000.

PRICE REDUCTION.—The domestic rate is to be reduced to a fixed standing charge of 15 per cent., of the rateable value of all houses (instead of the scale of percentages now in force) and after allowing 4 kWh per quarter per £ of net rateable value, the charge for further energy will be ¾d. per kWh.

Truro.—ELECTRICITY AGREEMENT.—The Town Council has approved a draft agreement with the Cornwall Electric Power Co. for a supply of electricity for the city.

Twickenham.—INQUIRY.—According to the *Surrey Comet*, an inquiry was recently held at the offices of the Electricity Commissioners by Sir Harry Haward and Mr. S. L. Pearce into the electricity charges of the Twickenham and Teddington Electric Supply Co. The inquiry was held on the application of the local authorities who appealed for an Order to vary the present authorised prices charged by the company. Mr. R. M. Montgomery, K.C., who represented the authorities, compared the charges with those of neighbouring companies, and stated that the high rate was detrimental to the property in the area. The authorities suggested a reduction of 3d. per kWh in the charges for lighting, a reduction of from 2d. to 1d. per kWh for power, and of 1d. per kWh for heating. Mr. N. Staniland, borough electrical engineer of Hornsey, stated that the company's charges would have a serious effect in deterring factories and other works from being opened on account of the prohibitive cost of electricity. Protests were also made by business concerns in the area. Mr. Craig Henderson, K.C., for the company, stated that the reduction of the maximum charge to 8d. per kWh, as suggested by the local authorities, would mean a reduction in the gross profit of approximately £10,000, which he contended was not justified at present. The reduction would also limit the company to paying a dividend of 5 per cent., which would prevent any further capital being raised. The Commissioners will give their decision in due course.

Winchester.—LOAN.—The Town Council has applied for sanction to a loan of £19,153 for the following purposes:—The installation of one 1,250-kW turbo-generator, with condensing plant and pipe-work, £8,100; foundations, £750; connecting cables and switchgear, £650; vee notch recorder, £100; boiler with mechanical stoker, piping and extensions to economiser, £4,964; foundations, £400; buildings and contingencies, £4,189.

Woolwich.—LOAN.—In connection with the proposed supply of electricity in bulk to Bexley and Erith, the Town Council has decided to apply to the Electricity Commissioners for sanction to a loan of £34,446 for transmission lines, switch panels, and transformers.

United States.—ELECTRICAL DEVELOPMENT.—According to *Power*, applications have been filed by the Los Angeles Municipal Bureau of Power and Light with the California and Arizona Water Commissioners and the Federal Power Commission for permission to divert the waters of the Colorado River near the town of Parker, Ariz. It is planned to construct a dam at this site which would make available approximately 1,500,000 acre-feet of water for the City of Los Angeles and would develop at least 100,000 h.p. of electrical energy.

Officials of the Southern Power Co. announced recently, the award to the American General Electric Co. of a contract for two 50,000-h.p. steam turbines for a plant to be built, to safeguard the company against recurrence of the drought of this year. The new plant will be rated at 100,000 h.p., instead of 80,000 h.p., as was originally planned.

Tramway and Railway Notes.

Continental.—SWITZERLAND.—Work is in hand on the electrification of the remaining portion of the railway between Zurich and Basle, and it is expected that the Bozberg section will be completed for electrical operation next month. The sections between Zurich and Brugg and between Basle and Pratteln have been electrically operated for some time.

Irish Free State.—LUCAN (CO. DUBLIN).—As the result of a conference at the Government Buildings, Dublin, between the City Administrative Commissioners and representatives of the Dublin United (Electric) Tramways Co., it is understood that an agreement has been reached for the early taking over of the Dublin and Lucan Electric Railway, closed down since the beginning of the year, and that the electricity supply to institutions and residents along the route will be restored. The line will be connected up at the main gate of Phœnix Park with the city service, thus giving a through service to the centre of Dublin. The Commissioners have agreed to grant an extension of the tramway company's lease. The terms of the agreement will be published shortly.

Nelson.—NEW CARS.—The TOWN Council is applying to the Ministry of Transport for sanction to a loan of £5,800 for the purchase of three new double-deck tramcars.

Sheffield.—PURCHASE OF TRAMWAY.—The Corporation will take over from Rotherham on January 1st next 2¼ miles of single tramway track between Tinsley depôt and the city boundary at Templeborough. The sum agreed upon for the track, overhead line work, and eight tramcars is £14,475.

Stockton.—TRAMWAY IMPROVEMENTS.—The Joint Tramways Committee has under consideration the doubling of the tramway track in Middlesbrough Road at an estimated cost of £13,700.

Stretford.—LOAN.—The Urban District Council is applying for sanction to borrow £11,837 in connection with the Talbot Road and Warwick Road tramway.

United States.—RAILWAY ELECTRIFICATION.—The electrification of the southern division of the Pennsylvania Railway, extending from Philadelphia to Wilmington, Del., a distance of 28 miles, will be started soon. The company announced on October 29th that arrangements had been completed to begin the preliminary work necessary in making the change from steam to electric operation.—*Electric Railway Journal.*

Worcester.—RAILLESS CARS.—The Streets Committee will ask the City Council at its next meeting to apply to Parliament for powers to replace the present tramway by railless cars, which, it is suggested, should be confined to the city, and that powers should be sought to run omnibuses on any routes in the city so that the Council may hereafter decide whether to adopt railless cars or omnibuses, or both.

Telegraph and Telephone Notes.

Canada.—DIRECTIONAL WIRELESS.—The Radio-Telegraph Branch of the Department of Fisheries announces the opening of a directional wireless station on Belle Isle, at the northern entrance to the Gulf of St. Lawrence. The new station will operate continuously on a wave-length of 800 metres, with the call letters "VCM." Belle Isle is the first landfall for transatlantic vessels traversing the northern route. The station will be equipped with its own generating plant.—*Reuter* (Ottawa).

Germany.—WIRELESS IN AEROPLANES.—The Aero Lloyd announces that, beginning with the winter season, its aeroplanes will be equipped with radio apparatus, which will enable the pilots to maintain constant communication with the aeroplane and meterological stations, and will therefore greatly increase the safety of flying.—*Reuter* (Berlin).

Irish Free State.—SHIPS' RADIO STATIONS.—The Irish Free State is almost unique in more ways than one. There are only two wireless stations—at Malin Head and Valentia—on the Free State coasts to which ships can appeal for help or guidance. Prior to the Treaty of 1921 numerous stations were available for emergency work and effectively watched the coasts of Ireland. When the transition of government took place all these stations were handed over to the Free State, and the majority were dismantled. What a serious matter this is for shipping has been demonstrated by a recent occurrence in Dublin Bay, says the *Irish Times*. Every ship of 1,500 tons registered in the Port of Dublin is obliged to carry wireless, and yet, should she get into difficulties a few miles outside the port, she is compelled to depend on the nearest wireless station, which happens to be Liverpool, 120 miles across the Irish Sea.

Russia.—TELEPHONE CAMPAIGN.—The Soviet Government has started a campaign to familiarise the Russian people with the telephone and its uses. At present the telephone plays a very small part in Russian life, there being less than one telephone to every 1,500 people, but the Soviet Government is said to be prepared to spend ultimately £20,000,000 in bringing the system up to date.

South Africa.—LONG-DISTANCE TELEPHONY.—According to the *British and South African Export Gazette*, the desired linking of Lourenço Marques with Johannesburg and Pretoria by telephone would cost over £25,000.

Radio Notes.

Brazil.—BROADCASTING SERVICE.—The Department of Overseas Trade informs us that the commercial secretary at Rio de Janeiro (Mr. E. Hambloch) reports the following particulars regarding broadcasting: There are 20 broadcasting stations in Brazil, which send daily communications to about 50,000 receiving apparatus. The number of such sets of apparatus in the Federal Capital of Rio de Janeiro is estimated at 20,000. The Radio Sociadade do Rio de Janeiro, with 6 kilowatts, and the Radio Club do Brasil, with 500 watts, send daily messages relative to trade, exchange quotations, meteorological service, and concerts, scientific addresses, &c. The Radio Sociedade also possesses an experimental 10-watt station, and another uses short waves for radio-telegraphy, with 40 watts, which has already succeeded in communicating with Swedish stations. The Radio Club has an experimental 1-kW station, while Mayrink, Veiga & Co. has an experimental 10-watt station. Two stations are working in Sao Paulo—the Radio Club de Sao Paulo, with 10 watts, and the Sociedade Radio Educadora Paulista, also with 10 watts. The latter will, however, shortly use 1 kW. The Sociedade Radio Educadora Paulista daily broadcasts commercial and meteorological information, as well as concerts, &c. There are three stations in Pernambuco, the largest being that of the Radio Club de Pernambuco (in the capital, Recife) of 300 watts. The others are the Radio Sociedade de Garanhuns and the Radio Sociedade Jader de Andrede, at Timbauba. The Radio Sociedade de Minas Geraes, installed at Bello Horizonte, uses 500 watts.

In other states of the Union the following stations are in operation:—Radio Sociedade de Bahia, 50 watts; Radio Club de Petropolis (State of Rio de Janeiro); Escola de Radiotelegraphie do Maranhao; Radio Club Clearense (Cears); Radio Sociedade de Parahyba (Parahyba do Norte); Radio Sociedade Pelotense (Rio Grande do Sul; and Radio Club de Campo Grande (Matto Grosso). It is estimated that more than 200,000 persons receive radio-telephonic communications from such broadcasting stations.

Broadcasting Inquiry.—GOVERNMENT COMMITTEE MEETS.—It is reported that the first meeting of the Broadcasting Committee appointed by the Postmaster-General, Sir William Mitchell-Thomson, was to have been held on November 19th. The British Broadcasting Co. is not represented on the Committee. The management, control, and finance of broadcasting after the expiry of the existing licence on December 31st, 1926, will be the chief subjects discussed. There are ten members of the Committee, the chairman of which is the Earl of Crawford, and, according to *The Times*, its sittings will begin early in December. In order that the Radio Society of Great Britain may be acquainted with the feelings of its members and of those of about 200 affiliated societies, arrangements have been made to hold a mass meeting, representaing about 15,000 persons, on November 26th. After a demonstration of "Talking Motion Pictures," by Mr. C. F. Elwell, there will be a debate on a resolution "That the present system of broadcasting, as represented by a single monopoly, is the best for this country." Prof. W. H. Eccles, past president of the Radio Society, will preside.

Canada.—FIRE INSURANCE.—Fire insurance companies in Canada are endeavouring to ascertain the part played by wireless in homes as a factor in increasing fire losses. American fire insurance companies have already made a slight increase

in premium to offset the additional risk of lightning and short-circuiting household wiring through tampering. Canadian companies, it is believed, will shortly follow suit.—*Reuter* (Ottawa).

Germany.—LICENCES.—There are now 838,904 radio receiving licences in operation throughout Germany. The licences are issued by districts; that of Berlin heads the list with 353,229, followed by Hamburg with 116,263, Leipzig with 102,014, Munich with 88,155, Frankfort-am-Main, 64,271, Breslau, 46,503, Munster, 27,380, Stuttgart, 26,819, and Konigsberg, Prussia, 14,270.

India.—BROADCASTING SCHEME.—The probability that within five years India and Ceylon will be equipped with ten broadcasting stations was suggested by Captain John Eaton Monins, of Burndept, Ltd., in an interview with a *Daily News* representative before his departure for India in connection with a wireless project. "Behind the scheme are four famous English wireless companies," he said. "Indian capital will also be interested. Already application for the requisite licences has been made to the Indian Government. At present India possesses only two small private broadcasting stations, at Calcutta and Bombay. First steps in the scheme will be to convert those into standard stations, and to erect one at Madras. Local relay stations will be set up to serve the different speaking territories."

S.B. Relaying.—NEW SWITCHBOARD.—A new switchboard is being erected at the Savoy Hill headquarters of the British Broadcasting Co. to enable 2LO programmes to be supplied to any of the Company's studios that cares to insert a plug in a socket at its own studio. Between London and Leeds four special lines have been set apart by the Post Office for the use of the B.B.C. Thirty amplifiers, each using three valves, will automatically feed the lines with the London programmes, says the *Daily Mail*, and it will thus be possible for 20 stations to receive the programmes, cutting out when they wish to broadcast their own.

The Philippines.—AMATEUR'S FEAT.—Amongst the recent achievements of Mr. F. A. Mayer, the well-known Essex amateur, was the establishment of communication with the Philippine Islands on November 9th between 2.30 and 4 p.m. G.m.t. This was the first two-way communication between this country and those islands. Mr. Mayer (G 2IZ) worked with Pi-IHR at Manila, which was in charge of Sig. Officer Hayden P. Roberts at Fort McKinley, the operator being Master Sergt. Angel D. Maningas, 12th Sig. Co., of the U.S. Army. Mr. Mayer used about 400 watts at the time on two T/250-type Osram valves, and his signals were reported to be strong and very steady, pure c.w. note, and the Manila signals were also very strong on two valves. The remarkable fact is that the communication took place in broad daylight on the 40-metre band; the signals faded out at sunset.

United States.—NATIONAL RADIO CONFERENCE.—The fourth National Radio Conference, convened by the Secretary of Commerce, Mr. Hoover, met at Washington on November 9th. The prospect that the Conference will determine whether wireless broadcasting is to be brought under Federal regulations, on the grounds of being a public utility, attracted many who would otherwise have stayed away. In his opening address to the delegates, Mr. Hoover indicated how far he was prepared to go in urging Federal legislation, and members of the committees of the Senate and House of Representatives, which will deal with such legislation, have accordingly been invited to attend the conference. The experimental work of the last two years, it is stated, has shown definitely that the limit has been reached in the number of first-class broadcasting stations, and measures will be discussed with a view to the reduction of the number of stations.—*Reuter* (Washington).

According to *The Times*, Mr. Hoover said that there were 578 broadcasting stations in the United States, of which 197 used at least 500 watts. The construction of a good modern station cost over $150,000 (£30,000), while the annual cost of running it, including artists' fees, approached $100,000 (£20,000). Of the new stations constructed this year, 32 used 1,000 watts, 25 used 5,000 watts, two used still higher power. Thus the range of non-interference between stations using the same wave-length was decreasing. With only 89 wave-lengths available for broadcasting, and more than 175 applications pending for new licences, the time had clearly arrived to abandon the policy of freedom of the air. The policing of the ether traffic should obviously be a Federal responsibility, but he would prefer that local communities should decide who was to use the wireless channels, in order that the public might more easily secure the elimination of undesirable features from broadcast programmes. To-day advertising provided the broadcaster's principal revenue, but freedom of speech in the air should not mean licence to individuals and firms to monopolise a listener's set with details about their business and descriptions of their wares. It was in the public interest that the new art should be developed to national advantage.

At a previous gathering the National Broadcasters' Association, reversing completely its attitude of a year ago, adopted a resolution recommending that full authority over the issuing of licences should be vested in the Department of Commerce. It was also resolved that the Copyright Law should be amended so as to fix a reasonable fee to composers for the broadcasting of their compositions and that no limitation should be placed on advertising.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Australia. — MELBOURNE. — December 15th. Postmaster-General's Department. Junction apparatus for manual exchanges.*

December 29th. Magnet and resistance wire.*

SYDNEY.—February 1st. Municipal Council. Bunnerong power house equipment. Six 25,000-kW turbo-alternators, 18 100,000 lb. per hour boilers, &c., and 33,000-V switchgear. (November 10th.)

Belgium.—December 3rd. Municipal authorities of La Gileppe. Equipment of a small hydro-electric station. Specification may be inspected at the office of the Distribution d'Eau at Verviers.

December 11th. Belgian Ministry of the Colonies, 7, Place Royale, Brussels. Wireless telegraphy transmitting and receiving apparatus for the Belgian Congo stations. Particulars on application from Cahier des Charges No. 1,049.

Bridlington.—December 7th. Electricity Department. One oil engine, direct coupled to a 275-kW d.c. generator, fuel storage tank, cooling tower, pipework, and pumps. (November 10th.)

Bristol.—November 23rd. Port of Bristol Authority. Electric lighting installation, Dock office extensions. Mr. H. T. Sully, consulting engineer, 28, Baldwin Street (returnable deposit of £2 2s.).

Cheadle and Gatley.—November 23rd. Urban District Council. Switchgear cubicle and transformer and switchgear kiosk. Specification from Electrical Manager, 37, High Street, Cheadle.

Dublin.—December 10th. Great Southern Railways Co. Stores for six months, including electric lamps, &c. Stores Superintendent, Inchicore, Dublin.

Egypt.—December 30th. Inspecting Engineer in London. Queen Anne's Chambers, S.W. Telegraph and telephone material and motor generator and telegraph apparatus.

ALEXANDRIA.—December 10th. Ministry of the Interior. Machinery in connection with the waterworks scheme at Mellawi, consisting of electric motors and centrifugal pumps, control panels, l.p. armoured cable, &c. (C.X. 1,796.)*

Exeter.—December 11th. Electricity Department. One 3,000-kW steam turbo-alternator and accessories. (See this issue.)

Glasgow.—The Corporation Health Committee is inviting offers for the erection of an electrical power station at Bellefield Sanatorium.

Hull.—November 23rd. Supply of 250 or 500 tons of tramway rails, with fishplates, &c. Form of tender from Mr. F. W. Bricknell, city engineer.

Telephone Committee. Bronze wire. (See this issue.)

India.—DELHI.—November 30th. Indian Stores Department. Sub-station equipment for Jaipur (comprising insulators, wire, l.p. cable, switchgear, transformer, &c.).*

London.—METROPOLITAN ASYLUMS BOARD.—December 2nd. Renewal of electric cables, &c., at the Brook (Fever) Hospital, Shooters Hill, Woolwich, S.E.

ISLINGTON.—December 17th. Electricity Committee. One 75-kW a.c. motor and d.c. generator, with starters, switchgear, &c., and three 5,000-kVA Scott-connected transformers, &c. (See this issue.)

H.M. OFFICE OF WORKS.—December 3rd. Electrical accessories.*

Manchester.—November 23rd. Tramways Committee. Iron and steelwork required at tramcar depôt, Birchfields Road, Fallowfield. Particulars from City Architect, Town Hall.

November 25th. Electricity Committee. Constructional steelwork for garage, Polyon depôt, Tower Street, Ardwick. Specification (No. 130) and form of tender from Mr. H. C. Lamb, manager, Electricity Department, Town Hall.

November 30th. One electrical storage testing battery for testing depôt, Polyon, Ardwick. Specification from Mr. H. C. Lamb, manager, Electricity Department, Town Hall.

Marlborough.—Borough Council. Conversion of 62 street lamps from gas to electricity, including connecting up to existing mains. (See this issue.)

New Zealand.—WELLINGTON.—January 19th, 1926. Public Works Department. 50,000- and 110,000-V switchgear and steelwork for the Waikato electric power scheme. (B.X.2,157.)*

January 26th. 50,000-V switchgear for the Waikato electric power scheme; transformers for the Lake Coleridge power scheme.*.

GISBORNE.—Borough Council. Diesel engine, alternators, and auxiliary plant, rotary converter, and switchboard. (November 10th.)

Oldham.—December 5th. Electricity Department. Eight water-tube boilers, with superheaters, chain-grate stokers, steel chimneys, and induced draught plant. (November 6th.)

Peterborough.—November 30th. Electricity Department. Buildings and civil engineering work, pulverised fuel equipment, two boilers and boiler-house equipment, one 6,000-kW turbo-alternator and turbine-room equipment, e.h.p. and l.p. switchgear, &c. (November 10th.)

Southall.—November 24th. Southall-Norwood U.D.C. Overhauling and maintaining the fire-alarm system. (November 10th.)

South Africa.—JOHANNESBURG.—December 14th. Electricity Supply Commission. Plant and material for transmission lines and sub-stations in connection with the supply of electricity in the Cape area rural districts.*

December 23rd. Union Tender Board. Telephone apparatus and supply of telegraph material for the Department of Posts and Telegraphs.*

December 17th. Municipal Council. 2,000-kW motor converter. (B.X. 2,142.)*

CAPE TOWN.—December 3rd. Electricity Department. Three-phase induction voltage regulators.*

Sub-station plant and transmission lines. (B.X. 2,139.)*

FORT BEAUFORT.—December 10th. Municipal Council. Generating plant and materials for electric lighting.*

QUEENSTOWN.—January 7th, 1926. Municipal Council. Extensions to the electricity undertaking.*

Switzerland.—November 28th. Swiss Federal Railway authorities, Berne. Two 3,000-kVA, 60/15-kV single-phase transformers and switchgear for the Mussaboden transformer station. Particulars for 5 fr. from the Abtheilung für Elektrifizierung, Zimmer No. 166, Dienstgebaude, 43, Mittelstrasse, Berne.

Thornton.—December 13th. Urban District Council Electricity Department. Supplying, laying, jointing, and coupling-up complete of an electricity supply system. (See this issue.)

Uruguay.—MONTEVIDEO.—January 18th. State Electricity Supply Works. 170,000 metres of r.i. cords.*

January 29th. Fuse wire, enamelled lamp shades, cut-outs, switches, lampholders, sockets, &c. (B.X. 2,126.)*

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Australia.—MELBOURNE.—State Electricity Commission of Victoria.—The Commission has accepted the tender of Weymouths, Ltd., for 40 transformers of from 200 to 500 kVA. (The value of the contract is approximately £30,000). It has also been decided that Messrs. Weymouths, Ltd., shall supply the Commission's requirements in transformers during the next two years. The accepted tender was 14 per cent. in excess of the next lowest tender—that of a Swedish firm—which was inclusive of 50 per cent. *ad valorem* duty.

Glasgow.—Tramways Committee. Accepted: —
Steel tubing for mains.—Stewarts & Lloyds and Scottish Tube Co., Ltd.
Lead-covered cable.—Western Electric Co., Ltd.
Special trackwork.—Titan Trackwork Co., Ltd.

Irish Free State.—Contracts placed by the Controller of Stores, Department of Posts and Telegraphs, during October, 1925:—
Batteries.—Pritchett & Gold and E.P.S. Co., Ltd.
Switchboard clocks.—Grimshaw, Baxter, and J. J. Elliott, Ltd.
Conduit and fittings.—Eureka Conduit & Fittings Co., Ltd.
Earth plates.—J. C. McLoughlin.
Switchboard cable.—Peel-Conner Telephone Works, Ltd.
Telephone wires.—McMillan & Co.

—*Irish Electrician.*

Lepton (near Huddersfield).—Urban District Council. Accepted:—
Installing electric lighting, exclusive of two-way switches, in the Council houses (£4 per house).—Electrical Distribution of Yorkshire, Ltd.

London.—UNDERGROUND ELECTRIC RAILWAYS CO. OF LONDON.—The company has placed orders with Cammell, Laird & Co. and the Metropolitan Carriage, Wagon & Finance Co. for 78 new cars required for service on the Morden and Kennington extensions, which will be ready for service next midsummer.

METROPOLITAN ASYLUMS BOARD.—Works Committee.
Automatic telephone installation at the Downs Hospital for Children:—

Commercial Telephone & Electrical Co., Ltd. (Recommended.)	**£748**
E. Shipton & Co., Ltd.	945
V. G. Middleton & Co., Ltd.	1,020
Reliance Telephone Co., Ltd.	1,064
Electrical Contracts & Maintenance Co. (1925), Ltd.	1,334

The following tenders were received for X-ray apparatus for the North-Eastern Hospital:—

Medical Supply Association, Ltd.	£283
Schall & Son, Ltd.	294
Watson & Sons (Electro-Medical), Ltd.	298
A. E. Dean & Co.	316
X-Rays, Ltd.	340
Newton & Wright, Ltd.	387

Manchester.—Tramways Committee. Accepted:—
Tramcar meters.—Chamberlain & Hookham, Ltd.
6-h.p. motor.—Smith & Coventry, Ltd.
5-h.p. motor.—W. T. Ellison & Co., Ltd.
Sample set of motor suspension gear for car trucks.—Brush Electrical Engineering Co., Ltd.

Richmond (Yorks.).—Town Council. Accepted:—
H.p. transmission line, sub-station equipment, and high-pressure network (£6,433).—Johnson & Phillips, Ltd.

Southend-on-Sea.—Town Council. Accepted:—
1,232 electricity meters of varying capacity (£3,097).—Chamberlain & Hookham, Ltd.

Winchester.—Town Council. Accepted:—
New boiler plant for the electricity works (£5,188).—Babcock & Wilcox, Ltd.

Forthcoming Events.

Electrical Trades Commercial Travellers' Association.—Saturday, November 21st. At the Manchester Hotel, E.C. At 7.30 p.m. Whist drive and social.

Nottingham Society of Engineers.—Monday, November 23rd. At the Victoria Station Hotel. At 7.30 p.m. Lecture on "A Factory Equipment," by Mr. M. A. Crosbie.

Shipping and Engineering Exhibition.—At Olympia. November 23rd to December 5th.

Royal Society of Arts.—Monday, November 23rd. At John Street, Adelphi, W.C. At 8 p.m. Cantor Lecture, "Coal Ash and Clean Coal," by Dr. R. Lessing.

Institution of Electrical Engineers.—INFORMAL MEETING.—Monday, November 23rd. At the Institution, Victoria Embankment, W.C.2. At 7 p.m. Discussion on "The Testing of Large Electric Plant," to be opened by Mr. E. E. Tasker.

(North-Eastern Centre).—Monday, November 23rd. At Armstrong College, Newcastle-on-Tyne. At 7 p.m. Paper on "The Engineer: His Due and His Duty in Life," by Mr. T. Carter.

(North Midland Centre).—Tuesday, November 24th. At the Hotel Metropole, King Street, Leeds. At 7 p.m. Paper on "The Engineer: His Due and His Duty in Life," by Mr. T. Carter.

(South Midland Centre).—Friday, November 27th. At the Grand Hotel, Birmingham. Annual dinner.

(London Students' Section).—Friday, November 27th. At the Institution, Victoria Embankment, W.C.2. At 6.15 p.m. Paper on "The Tungar Rectifier," by Mr. A. P. Hill.

(North-Western Centre, Students' Section).—Tuesday, November 24th. At Milton Hall, Deansgate, Manchester. At 7.30 p.m. Paper on "The Automatic Control of d.c. and a.c. Feeders," by Mr. C. Ryder.

Institute of Physics.—Wednesday, November 25th. At Burlington House, Piccadilly, W. At 5.30 p.m. Lecture on "The Physicist in Agriculture, with Special Reference to Soil Problems," by Mr. B. A. Keen.

South Wales Institute of Engineers.—Engineering exhibition at the Drill Hall, Cardiff. November 26th to December 3rd.

Junior Institution of Engineers.—Friday, November 27th. At 39, Victoria Street, S.W. At 7.30 p.m. Lecturette, "The Engineer and His Relationship to the Tea Industry," by Mr. E. Granville-Smith.

Institution of Mechanical Engineers.—Friday, November 27th. At the Institution, Storey's Gate, S.W. At 7 p.m. Informal meeting. Discussion on "The Work of the Mechanical Engineer in Non-Engineering Industries," to be opened by Mr. W. P. F. Fanghanel.

Institution of Engineering Inspection (Inc.).—Friday, November 27th. At the Hyde Park Hotel, London. Annual reception and presidential address, followed by a dance and concert.

Physical Society of London.—Friday, November 27th. At the Imperial College of Science, South Kensington, S.W. At 5 p.m. Ordinary scientific meeting.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names of makers or suppliers of:—

SIGLIT signalling lamps.
VAMPYX vacuum cleaners.
LOEWE resistances.

Notes.

Parliamentary.—The autumn session of the House of Commons opened on November 16th. The Prime Minister, in reviewing the programme, stated that it would be impossible to proceed with the Merchandise Marks Bill, and Bills to amend the Factory and Workshop Acts.

Mr. Baldwin informed Mr. Crawford that although the examination of the electricity proposals was proceeding, it had not reached such a stage as to enable him to announce the Government's plans. He hoped that he would be able to make a statement before the House rose. The delay which had occurred was due to the complexity of the subject.

London Traffic Inquiry.—The inquiry into the travelling facilities of North London was continued at the Middlesex Guildhall, Westminster, on November 10th and subsequent days. Mr. C. J. Spencer, general manager of the Metropolitan Electric Tramways, stated that the competition of independent omnibuses had put a stop to schemes for further development in the area served by the company. Mr. E. Pick, assistant manager to the Underground Group, stated that the underground railway at Finsbury Park was not used to its full capacity, and that during the past four years there had been a falling off in the number of passengers carried due to independent buses. There could be no tube developments in London until the surface transport was controlled.

Fatality.—An inquest was held at Dolgarrog on November 12th into the death of Michael Riordan, who was killed, while three other men were seriously injured, during the boring of a tunnel between Eigiau and Cowlyd Valleys, Carnarvon, for the North Wales Electric Power Co. It was stated that a charge failed to explode, but when the men went to examine it an explosion occurred. A verdict of "Accidental death" was returned.

Shipping and Machinery Exhibition.—The committee of the Shipping, Engineering, and Machinery Exhibition invites all visitors from overseas associated with the shipping, engineering, and machinery industries who happen to be in England on December 1st next to apply to Mr. F. W. Bridges, Avenue Chambers, Southampton Row, London, W.C.1, for complimentary tickets for the dinner to be given at the exhibition on that date in honour of oversea guests. Although a great number of invitations has already been issued direct by mail, the management is very anxious that all visitors from the Dominions and other parts abroad who may not have received invitations may do so.

Educational.—FRENCH ELECTRICAL SCHOOL.—The foundation stone of the new buildings of the Ecole Superieure d'Electricité was laid by M. Doumergue, president of the French Republic, at Malakoff on November 9th. The old school, which was built in 1893, has become too small for the accommodation of the growing number of French and foreign students, who now number 225, which is the maximum limit. Thanks to subscriptions of 5,000,000 fr. by electrical firms, 4,000,000 fr. by the State, and 2,000,000 fr. by the city of Paris and the Council of the Seine, a total of 11,000,000 fr. has been collected, but an amount of 4,000,000 fr. still remains to be raised so as to provide the school with modern equipment. It is intended to complete the new buildings in 1927.

POPLAR SCHOOL OF ENGINEERING.—An Old Boys' Society has been formed for the purpose of bringing together old day students of the Poplar School of Engineering. Further particulars are obtainable from Mr. Thos. L. Farnes, hon. secretary, 140, Mitcham Road, East Ham, London, E.6.

Automatic Control of Railway Engines.—A radio-operated safety device that checks running locomotives automatically when danger looms ahead was recently given a successful demonstration over a 10-mile stretch of Pere Marquette railroad, U.S.A. By means of a system of radio-controlled signal lights installed in the engine cab, it was demonstrated that if the engineer is disabled, the system of control checks the engine's speed and brings it to a halt at any danger point, at any time. The working depends on the propagation of electro-magnetic waves flowing in the track rails with varying wave-lengths which operate on the visual signal device in the engine cab. The Michigan Central railroad has equipped ten locomotives and ten miles of track between Jackson and Rives, Michigan, with the Clark radio control device.—*Reuter* (Detroit).

The Lord Mayor's Show.—One of the features of this year's show on November 9th was the telegraph cable companies' effort to express what communications mean to trade. The great cable companies were represented by two cars. In one a boy messenger lay upon a rock, taking with outstretched arm a message from Neptune emerging from the seas. The other car held a great pasteboard globe with the cable routes traced on it, and at the corners stood a Chinaman, a gold miner, a rancher, and a Colonial sheep farmer, emblematic of Asia, Africa, America, and Australasia. John Bull drove the four horses which pulled the car.

The Finsbury Technical College Old Students' Association.—ANNUAL DINNER.—On Saturday last the annual dinner of the Finsbury Technical College Old Students' Association was held at the Engineers' Club, London; over 100 members and guests were present, including ladies for the first time. Mr. E. S. Conradi, President of the Association, was in the chair. After the loyal toast, Lt.-Col. K. Edgcumbe, M.I.E.E., proposed "The College," and remarking that there was a cloud over it at present, he reviewed the circumstances under which its work had been carried on during the past four years, and paid a tribute to the extraordinary efforts that had been made by the special committee of the Council to secure its continuance. Finsbury owed its greatness to the personality of its professors. The committee had done its utmost and owned itself beaten; but was it not for the best that a great institution should be cut off in its prime, instead of eking out a precarious existence to an inglorious end?

Prof. A. J. Hale, F.I.C., Dean of the College, responded, expressing the feeling that the closing of Finsbury would mean the loss of something well worth keeping. Finsbury had never given degrees, which were so much sought after nowadays, but had trained men to be useful in industry very successfully for forty years; 3,000 students had passed through the College, of whom 2,000 were engineers, and 700 chemists. The Meldola Memorial Fund had provided them with a most useful library, and like the Streatfield and Thompson Memorial Lectures, was due to the Old Students. In view of the threatened closing of the College in its present form there was a strong feeling that it should be converted into a college of chemical engineering and applied chemistry, for which undoubtedly there was scope. That proposal was under consideration and might possibly be put into effect.

Mr. E. R. Bolton, F.I.C., proposed the toast "F.T.C.O.S.A.," and said that the College was a live body with a soul; if it was shut up the Old Students' Association would go on.

Responding, Mr. Conradi, after referring to the severe illness of Captain Wallis-Jones, to whom a telegram of sympathy was sent, described the work done by the Council and Committee, which had brought forth plenty of sympathy but no money. Mr. C. E. Elcock had been of great assistance in putting the facts before the Educational Trusts. Finsbury was going down with its flag flying; it had gained a wonderful reputation, and the Old Students would carry on its traditions. It was proposed that a Finsbury Scholarship should be founded, and he hoped that the Old Students would help in this.

Mr. R. W. Paul, M.I.E.E., proposed "The Guests" in a humorous speech. He did not feel depressed, for if the College did no more work it would live in memory. The College was really the men who had passed through it, and its spirit would continue. They would all do their best to help the Old Students' Association.

Mr. C. E. Elcock, F.R.I.B.A., responded, remarking that that was the pleasantest "wake" he had ever attended. He described his negotiations with the Educational Trusts and urged that the O.S.A. should itself form a Trust to assist technical education. Mrs. Price also briefly responded to the toast.

A capital entertainment was provided, and the President, in conclusion, expressed the gratitude of the audience to the musical director, Mr. L. M. Clark, and the hon. secretary, Mr. Grant, for their arduous and successful labours.

The Streatfield Memorial Lecture will be delivered on December 3rd.

A French 150,000-volt Cable.—The Société Générale de Force et Lumière has just laid an underground cable on the line Moutiers-Lyons of a length of 18 miles and having a service pressure of 150,000 volts to earth and capable of reaching 300,000 volts between the positive and negative conductors.

British Cast Iron Research Association.—We have received copies of the Quarterly Bulletin, No. 10, October, 1925, and the fourth annual report for the year ended June 30th, 1925 of the above Association. An article on "The Influence of Aluminium on Cast Iron" contains some interesting information with reference to high-resistance alloys. The annual report shows that at the end of the year the total membership of the Association was 275, compared with 248 at the end of the previous year. The income for the year was higher than that of any previous year, and for the first time reached the minimum originally stipulated by the Department of Scientific and Industrial Research (£2,500 per annum), as a qualification for the Government grant. Mr. H. B. Weeks, F.I.C., has been re-elected chairman of the Association for the ensuing year.

B.E.S.A. Specification.—The British Engineering Standards Association has issued a specification (No. 215, 1925) for hard-drawn aluminium and steel-cored aluminium conductors for overhead power transmission purposes. It is very similar in general lines to that for hard-drawn copper solid and stranded circular conductors, and gives full details of the number of strands, weight, resistance, tensile strength, &c., of the standard sizes of aluminium and steel-cored aluminium conductors. The standard sizes are based upon the standard sizes of hard-drawn copper conductors, there being an aluminium or steel-cored aluminium conductor of equivalent resistance to each primary standard size given in B.E.S.A. specification 125-1924. Some useful notes are given, explaining how the values in the various tables have been arrived at. One of the most interesting features of the specification is the appendix which gives the British standards of resistance of aluminium for electrical conductors. These standards have been agreed upon by the National Physical Laboratory and the Laboratoire Central d'Electricité, Paris, and constitute the first authoritative data on the resistance of aluminium to be published in this country. They are also being submitted to the International Electrotechnical Commission for adoption as international standards. Copies of the new publication may be obtained from the B.E.S.A. Publication Department, 28, Victoria Street, London, S.W.1. price 1s. 2d., post free.

Lighting Service Bureau Lectures.—On November 9th, at the Lighting Service Bureau, 15, Savoy Street, Mr. Beauchamp, of E.D.A., gave the first of a series of educational lectures which have been specially arranged for women working in the electrical industry and a number of prospective lecturers for the Electrical Association for Women. Mr. Beauchamp traced the journey of 1¼ lb. of coal through its conversion into electricity and eventually into the house of the consumer. The next lecture was to be held on November 16th, and the third will be given on November 30th. All showroom assistants and other women working in the electrical industry are invited.

Illuminated "White Line."—The first illuminated "white line" for the guidance of traffic round dangerous corners was tested on the North Circular road at Hendon, where it joins Golders Green Road. According to the *Daily Mail*, it was visible 200 yards away to motorists, who slowed down when they saw it and kept well on the proper side of the road. The line, which is the invention of Mr. R. F. Brown, a surveyor, of Great Clacton, Essex, consists of alternate pieces of glass and white tile an inch wide inserted flush with the road surface. Beneath this is watertight iron casing through which runs a line of electric light bulbs. The power is supplied from the electric main at the side of the road. The lamps are lit automatically and put out at daybreak.

Cable Ship in Distress.—The cable ship *Lord Kelvin* reached Queenstown on November 10th after an ordeal in an Atlantic gale, as reported in our last issue.

Medical Colour Treatment.—Dr. J. Dodson Hessey, writing in a recent issue of the *Practitioner* on the subject of colour treatment for certain diseases, states that he has had successful results with such treatment. The three most useful colours are green, blue, and orange, and the treatment is given by means of a 1,000-candle-power lamp; the patient wears a minimum of clothing, preferably a white gown.

Fuel Research Board.—The report of the Fuel Research Board (Stationery Office, 1s. 6d. net) for the period ended December 31st, 1924, is the first to be presented since 1920, and it covers the work of the intervening five years. Signed by Mr. C. H. Lander, who succeeded the late Sir George Beilby as Director, the report indicates that, owing to the increased volume of work now undertaken at the Fuel Research Station at East Greenwich and elsewhere, it is intended in future to prepare an annual report to assist those who are interested in keeping in touch with the various developments.

Progress in Electrodeposition.—In the course of an address entitled "Recent Advances in Electrodeposition" to the members of the Sheffield Section of the Institute of Metals recently, Mr. S. Field said the processes of electrodeposition were permeating many industries. New and surprising methods had been introduced, and some remarkably skilful work had been achieved. Organised research work was in progress in a number of laboratories. The scope of this work in this country was, however, much more limited than in America, where organised research on a large scale was in progress. In this country, too, there had been a lack of organisation amongst those engaged in the processes of electrodeposition. Nearing, as we were, the centenary of the enunciation of the fundamental laws of electrolysis, there was at least some prospect of rectifying these omissions and of more rapidly building on the foundations which were so well and truly laid by Michael Faraday in 1833, the pioneer in the realm of scientific electrodeposition.

Steam Pan Explosion Report.—We have received a copy of the report of a preliminary inquiry into the explosion of a steam jacketed pan, which occurred at the works of Messrs. W. T. Henley's Telegraph Works Co., Ltd., in June last. The explosion was violent, but owing to the connecting pipe being well secured to the inner and outer bottoms the steam escaped from the jacket through the annular opening around the top of the jacket without completely ejecting the inner pan. The pan was originally fitted with three screwed stays at the bottom, but these were omitted when a repair was made. Grooving of the weld at the top flange was set up by panting owing to the omission of the stays, and the plate failed ultimately at the wasted part.

Continental Automatic Sub-Stations.—In our issue of October 23rd, in an article on automatic and remotely-controlled rotary converters manufactured by the Metropolitan-Vickers Company, two 1,000-kW automatic sets at Copenhagen were referred to as "the only automatic ones on the Continent of Europe." We are informed that a completely automatic rotary converter equipment was installed by the Swiss Brown, Boveri Co. at Riehen, near Basle, as far back as the autumn of 1919. This equipment, which supplies the local Basle-Lörrach tramways, has, we understand, operated continuously and faultlessly ever since.

World Power Conference.—All the nations which are members of the World Power Conference have been invited to be represented at a sectional meeting in September of next year, in connection with the International Waterways and Hydraulic Power Exhibition. The agenda includes discussions on the application of electricity to agriculture, the electrification of railways, and the exchange of electric power between different countries.—*Reuter* (Basle).

Particulars of the proposed meeting at Basle were given in the ELECTRICAL REVIEW of September 25th, p. 505.

Electroplaters' and Depositors' Technical Society.—A Society with this designation, the latest concerned with technical applications of electricity, was founded at an inaugural meeting held at the Northampton Polytechnic Institute, Clerkenwell, on November 11th, over which Mr. S. Field presided.

The Principal of the Institute having addressed a welcome to those present, the chairman stated that the need had long been felt for a society in London where electroplaters and electrodepositors could discuss their problems and where they could come into contact with those engaged in research work on electrodeposition. Such contact could not fail to benefit both parties. The skilled plater possessed a fund of experience and empirical knowledge with which the "scientific" electrochemist should be acquainted, while the methods and results of the laboratory research worker could not fail to be useful to the practical plater when put to him in language which he could understand. A society of this character already existed in America, and there were local societies in Birmingham and Sheffield where plating problems were discussed.

Mr. F. S. SPIERS, who spoke on behalf of the Faraday Society, said that Society was greatly interested in the movement which had culminated in the present meeting and it was at the instigation of its Council that a Committee had been formed to consider the best lines on which an electroplaters' society should be constituted. It was at first thought that a special plating section of the Faraday Society would serve the purpose, but there were many weighty objections against that course, and the conclusion was reached that the needs of the plater could only be met by the formation of an independent group or society. The Faraday Society was, however, desirous of associating itself with the new body and the Council had agreed to the proposal to nominate representatives on its Committee. The new Society would cover the whole field of electrodeposition, which now included not only metals such as gold, silver and nickel, which were usually associated with the term "electroplating," but also zinc, iron, copper, cobalt, chromium, lead, tin, and other metals, all of which were now being industrially deposited.

Mr. D. J. MACNAUGHTAN, of the Research Department, Woolwich, expressed his belief that the proposed Society would help to break down the barriers at present existing between the practical plater and the research worker, and Mr. W. JAMES, speaking on behalf of the plating industry, endorsed this view. Platers were fully alive to the need for adopting the latest scientific knowledge in the practice of their art. In particular they would respond very heartily to the inspiration which they would derive from association with the name of "Faraday."

The resolution, by which the Society was formally created, was moved by Mr. S. FIELD and seconded by Dr. R. S. HUTTON, director of the British Non-Ferrous Metals Research Association. A Provisional Committee to frame rules and inaugurate the work of the Society was then elected, consisting of Messrs. S. Field (chairman), W. James (treasurer), L. Goring, W. F. Pitcher, F. S. Spiers, J. S. Sunderland, who represents electrotyping interests, and W. E. Harris, honorary secretary. The representatives of the Faraday Society were Mr. Field, Mr. Spiers, and another, who would be nominated later.

The Society will probably hold two types of meetings; those at which papers will be read and discussed and which will be open to visitors, and informal discussions, of which no report will be published, open to members only. It is intended to offer the papers read for publication in a suitable trade journal and consequently a subscription of 5s. per annum, with a reduced subscription for learners and improvers, is likely to suffice to cover working expenses. The first ordinary meeting of the Society will be held on December 9th at 8.15 at the Northampton Polytechnic Institute, when an inaugural address will be given by Mr. S. Field, which is expected to deal with recent progress in electrodeposition.

Appointments Vacant.—Plumber-jointer, for the Great Yarmouth Corporation electricity and tramway departments; assistant sub-station attendant, for Stoke Newington Borough Council electricity department; charge engineer, for the Tunbridge Wells Corporation electricity department. (See our advertisement pages to-day.)

Institution Notes.

Institution of Electrical Engineers.—INFORMAL MEETING.—At the meeting of the Informal Section on Monday, November 9th, Mr. E. S. Ritter opened a discussion on "Modern Developments in Telephone Cables." He had spared no pains in the preparation of numerous charts and diagrams, and these were examined with great interest by a number of those present. His survey was not historical so much as a description of and summary of the results achieved to date, and an illustration of the difficult problems that telephone transmission offers in comparison with those of power transmission. He described the underground line from London to Glasgow, with its five repeater stations along the route, produced samples of the most recently constructed cables, describing their construction, and testified to the skill of British cable makers in attaining and even surpassing the rigorous standards of capacity and deviation prescribed by the Post Office. Fifteen speakers joined in the subsequent discussion and more than one urged the need to co-relate the terminology and adopt standard terms and definitions, now that interlinking with the Continent is in view.

SCOTTISH CENTRE.—Prof. Magnus Maclean, M.A., D.Sc., delivered his inaugural address as chairman of the Centre at Glasgow on November 10th. Dr. Maclean was largely instrumental in getting the Scottish Centre formed, and this is the second occasion on which he has acted as chairman. His address was devoted to the early history of the Centre and its activities.

Junior Institution of Engineers.—NEW OFFICERS.—At the annual general meeting held on November 13th, the following officers were declared elected:—Chairman, Mr. A. J. Simpson; vice-chairmen, Messrs. R. L. Kirlew and C. E. Atkinson; hon. treasurer, Mr. C. O. Hourant; hon. librarian, Mr. T. W. P. Mullings.

National Association of Supervising Electricians.—FORTHCOMING EVENTS.—On Tuesday, December 1st, at the Junior Institution of Engineers, 39, Victoria Street, S.W., Mr. F. Hope-Jones will deliver his lecture on "Electric Time Service," in place of the lecture on "Research in Cable Industry" by Capt. P. Dunsheath, who will give his lecture on April 6th, 1926.

Royal Institution.—CHRISTMAS LECTURES.—The hundredth annual course of Christmas lectures for juveniles will be delivered by Sir William Bragg, on "Old Trades and New Knowledge." "The Trade of the Sailor" is the title of the first lecture on Tuesday, December 29th, and the following five lectures will be on the trades of the smith, the weaver, the dyer, the potter, and the miner.

Institution of Structural Engineers.—EXAMINATION.—We have received a syllabus of the examination of the Institution, which comes into force from January 1st, 1926. It sets forth qualifications which exempt candidates from the examination for the various classes of membership. From January 1st, 1926, admission will be by examination or exempting examinations only, but applications for direct admission from candidates having practical experience can be accepted up to that time.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.)

Captain A. ANGERS, A.M.I.E.E., F.R.M.S., of Messrs. A. Angers & Co., electrical, &c., engineers, Liverpool, who has been laid up for the past six months suffering from double pneumonia, has sufficiently recovered to be able to leave his room. He desires to thank many friends for their letters of sympathy. Mr. Angers, who has been a member of the Liverpool City Council for the past four years and a member of the Electric Light Committee, stood in the recent municipal election as Conservative candidate in a three-cornered fight and secured a large majority though unable to conduct the campaign personally owing to his illness.

Mr. J. HILLIER FRENCH, who has for about four years been chairman of the Works Committee of the Maidstone Corporation Electricity Committee, has been presented by the members on his retirement from the Town Council with an inscribed barometer, and by the employés of the electricity works with a silver fruit dish.

Mr. C. E. WOOD, who has for some years been chief of the accountancy department at the Stamford Electricity Works, has been appointed manager of the works in succession to Mr. C. L. Holman.

The *Daily Telegraph* states that Mr. KENNETH BELBEN ANDERSON, who died at Camberley on Friday last, was a director of the Exchange Telegraph Co. and a grandson of Sir James Anderson, formerly managing director of the Eastern Telegraph and allied companies, and was associated with Sir John Pender in the pioneer work of submarine telegraphy.

The presentation of a gold watch and fob to the general manager, Captain W. VANE-MORLAND, and of a case of afternoon tea knives to Mrs. MORLAND, prior to their departure for Walsall, was made by the staff of the St. Helens Corporation Tramways, last week.

Captain F. C. BURSTALL, of the Liverpool telephone service, has been appointed telephone traffic manager to the Egyptian Government, to whom he has been loaned by the Post Office authorities for a period of three years. Capt. Burstall entered the service of the National Telephone Co. in 1904 and was one of its divisional traffic superintendents.

Alderman WILFRED TURNER, chairman of the Bradford Corporation Electricity Committee for many years past, has relinquished the chairmanship for the new municipal year owing to his appointment as Deputy Lord Mayor. The chairman of the Electricity Committee for this year is Councillor J. W. LONGLEY, hitherto vice-chairman, and himself a consulting engineer.

Councillor H. FOULSTONE, who has been installed as Mayor of Barnsley, has, as chairman of the Electricity and Lighting Committee, done much to assist in the development of the electricity undertaking, and enthusiastic reference to this was made at last week's ceremony.

Councillor W. TUMMON has been re-elected chairman of the Sheffield Electric Supply Committee, and Alderman STYRING the deputy chairman.

SIR CHARLES J. STEWART and Mr. H. MORGAN have resigned from the Board of Marconi's Wireless Telegraph Co., Ltd., and SIR FREDERICK J. BARTHORPE, D.L., late chief joint general manager of the London County and Westminster Bank, Ltd., and SIR WILLIAM SLINGO have been appointed to fill the two vacancies.

Mr. H. K. BEALE has been re-appointed chairman of the Birmingham Corporation Electric Supply Committee.

The South African Power Engineer states that Mr. H. M. S. MULLER, of Lindley, O.F.S., has been appointed electrical engineer to the Municipality of Beaufort West, and that Mr. STAKESBY LEWIS, previously engineer of Frankfort, O.F.S., has been appointed engineer of Aliwal North.

Mr. P. S. G. REDFERN has been appointed salesman on the staff of the Birmingham branch of Messrs. Johnson & Phillips, Ltd. For some three years he has been associated with the Telephone Manufacturing Co., Ltd., in the same district. Mr. A. L. VINE, who has for some time been associated with Messrs. W. T. Henley's Telegraph Works Co., Ltd., in North Wales, has been appointed salesman on the staff of the Portsmouth branch of Messrs. Johnson & Phillips, Ltd.

Alderman A. A. THOMSON and Alderman G. J. ALLEN, J.P., have been elected chairman and vice-chairman, respectively, of the Croydon Corporation Tramways Committee.

Obituary.—MR. A. C. DEVEY.—Our readers will learn with regret of the death of Mr. Arthur Charles Devey, which occurred about a month ago at Boulogne at the age of 58 years. Mr. Devey, who was the youngest son of Mr. C. H. Devey (late Master of the Vintners' Company and twice Master of the Founders' Company), was born on November 11th, 1866, and was educated at Westminster and Tonbridge Schools. He early became an electrical engineer, and it is said was one of the first to install electric light in a private house. After some time in France, Belgium, and Italy, Mr. Devey joined the British Insulated & Helsby Cables, Ltd., of Prescot, and was with the company for many years, making numerous friends in the electrical world. Ill-health compelled him to retire several years ago, a pension being granted as a token of esteem—a mark of appreciation which he highly valued. During the war he rendered splendid service to the cause in both France and England. Here he was a member of the National Guard, and as in so many other cases where men who had passed the period for most strenuous activity worked on Saturdays and Sundays as well as through the week; he paid the penalty in a complete breakdown of his health. It was while thus suffering that he was suddenly taken with appendicitis and peritonitis. Two operations were performed and he bore these with such fortitude that the Hospital authorities wrote of "*son courage et douce sérénité*," but on the third day he passed away at Boulogne-sur-Mer. His home was at Wimereux, where he had lived for seventeen years. Mr. Devey was a member of the Institution of Electrical Engineers and of the Founders' Company.

MR. S. DEAN.—The death occurred recently of Mr. Samuel Dean, who was the first electrician at Port Sunlight (Lever Bros., Ltd.), when the original installation was set up 35 years ago.

MR. H. V. HIGGINS.—Mr. Harry Victor Higgins, who was one of the victims in the flood disaster at Dolgarrog, was an electrical engineer. He was 30 years of age, and served his apprenticeship with Messrs. J. B. Saunders & Co., of Cardiff and Welshpool. Subsequently he became a linesman with the North Wales Power Co., and about a year ago he was transferred to the Dolgarrog power station.

BRIG.-GEN. R. MARR-JOHNSON.—We regret to announce the death of Brigadier-General R. Marr-Johnson, C.M.G., D.S.O., which occurred on November 15th, after a serious illness, following an operation. General Johnson was a director and deputy-chairman of the Radio Communication Co., Ltd. He joined the board of that company after the completion of a brilliant military career in the Royal Regiment of Artillery.

New Companies Registered.

Polar, Ltd. (209,561).—Private company. Registered November 9th. Capital, £100 in £1 shares. Objects are: To adopt an agreement with the Radio Communication Co., Ltd., to acquire the trade mark "Polar" (registered No. 460,152 at the British Patents Office, Trade Marks Branch), and to carry on the business of agents, concessionaires for general or radio engineers, manufacturers and suppliers of and dealers in radio apparatus, &c. The subscribers (each with one share) are:—B. Binyon, Harthorndene, Hayes, Kent, company director; G. D. Cyanue, A.M.I.E.E., Fordcombe, Tunbridge Wells. The first directors are to be appointed by the subscribers. Qualification, £1. Remuneration as fixed by the company. Solicitors: Amery, Parkes & Co., Effingham House, Arundel Street, W.C.2.

Cutting Bros. & Co., Ltd. (209,526).—Private company. Registered November 7th. Capital, £22,000 in £1 shares (10,000 7 per cent. first cumulative preference, 10,000 7 per cent. second non-cumulative preference, and 2,000 ordinary). Objects: To carry on the business of electrical engineers and contractors, electricians, manufacturers of and dealers in wireless apparatus of all kinds, &c., and to adopt an agreement with T. W. Jourdan, C. H. Cutting, and G. H. Cutting. The first directors are:—T. W. Jourdan, Alsabrook House, Tiverton, Devon; C. H. Cutting (managing director), Austin House, Stamford, Lincs.; G. H. Cutting, 8, Rutland Terrace, Stamford, Lincs. Qualification, £300 shares. Remuneration, £150 per annum, divided between them. Secretary: G. H. Cutting. Solicitors: W. A. G. Davidson & Co., Bank Buildings, Acton, W., and Wembley Hill, Middlesex. Registered office: Park Works, Stamford, Lincs.

Hiberian Gas and Electric Investment Co., Ltd. (209,536).—Registered as a private company November 7th with a nominal capital of £500 in £1 shares. The objects are:—To acquire and to receive and hold on deposit as nominees or trustees and deal with shares or interests in any gas or electrical undertaking in Spain, Portugal, and their respective colonies, protectorates and dependencies, &c. The subscribers (each with one share) are:—A. Santerne, 24, Eastlake Road, Camberwell, S.E.15, translator; J. A. Steemson, 35, Auckland Road, S.W.11, advocate's clerk. The first directors are to be appointed by the subscribers. Provision is made for notices to be sent to members (if necessary) at addresses supplied by them in the U.K., Holland, Belgium, Germany, Luxemburg, France, Switzerland, Austria, Italy, Spain or Portugal. Secretary (*pro. tem.*): A. Santerne. Solicitor: J. E. M Crowther, 23, Abingdon Street, Westminster.

Grant Merchant & Co., Ltd. (209,641).—Private company. Registered November 12th. Capital, £1,000 in £1 shares (700 preference and 300 ordinary). Objects: To acquire the businesses of advertising contractors and manufacturers of electrical signs carried on at Duke Street Adelphi, W.C., as Grant Merchant & Co.; to adopt an agreement with S. H. Grant and W. W. Rogers; and to carry on the said business and that of manufacturers of and dealers in electrical and mechanical motors and accessories, gramophones, wireless and radio-active appliances, &c. The subscribers (each with one ordinary share) are:—G. H. Jones, 159, Woolstone Road, Forest Hill, S.E.23, clerk; P. G. Wilson, 1, Bush Lane, E.C.4, clerk. The first directors are:—S. H. Grant, W. W. Rogers and W. G. S. Naunton, addresses not stated. Qualification, 100 ordinary shares. Remuneration as fixed by the company. Solicitors: Peter Thomas & Clark, 1, Bush Lane, E.C.4.

Official Returns of Electrical Companies.

Tees Power Station Co., Ltd.—Satisfaction to the extent of £19,900 on various dates between April 1st and June 24th, 1925, of trust deed dated May 7th, 1918, securing £600,000 debentures. Notice filed November 7th.)

Leatherhead and District Electricity Co., Ltd.—Satisfaction to the extent of £6,200 on September 30th, 1925, of trust deed dated December 2nd, 1920, securing debentures for sums not exceeding the amount of the issued capital for the time being. Issue on October 19th, 1925, of £20,000 debentures, part of a series already registered.

Whitstable Electric Co., Ltd.—Particulars filed of £20,000 debentures authorised by resolutions of September 3rd and October 16th, and covered by trust deed dated October 20th, 1925, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £10. Trustees: W. H. Reeves and A. Collar.

Astro Electric, Ltd.—F. Wilcock, of 1, Great Winchester Street, E.C.2, ceased to act as receiver and manager on November 3rd, 1925.

Humavox, Ltd.—First mortgage debenture dated November 6th, 1925, to secure £1,015, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: W. J Jennings, 75, New Street, Birmingham.

Emerald Radio Co., Ltd.—Debenture dated October 28th, 1925, to secure £300, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: A. E. Pater, 1, Arcade House, Hendon, N.W.1.

Rubon, Ltd. — Debenture dated October 27th, 1925, to secure £500, charged on the company's property, present and future, including uncalled capital. Holders: T. Depries, M. Seelig and S. Harrison, trading as the S.D.H. Manufacturing Co., 24, Stoke Newington Road, N.

Arthur Raybould, Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated October 26th, 1925, to secure all moneys due or to become due from the company to Barclay's Bank, Ltd.

Beresford Bros., Ltd.—Mortgage dated October 30th, 1925, to secure £4,000, charged on 108, Dale End, Birmingham. Holders: L. P. Samuel, Pershore Road, Edgbaston, Birmingham; and F. J. Rogers, 67, Wake Green Road, Moseley, Birmingham.

Macintosh Cable Co., Ltd. (72,097.)—Capital, £100,000 in 75,000 ordinary and 25,000 preference shares of £1 each. Return dated October 6th, 1925. 51,008 ordinary and 23,997 preference shares taken up. £13,004 paid. £62,001 considered as paid. Mortgages and charges, £6,500.

British Electric Traction Co., Ltd. (49,855).—Capital, £2,998,397 15s. stock. Return dated June 29th, 1925. £2,039,007 15s. stock issued and paid for in full. Mortgages and charges, £1,620,012.

Potteries Electric Traction Co., Ltd. (57,968).—Capital, £600,000 in 300,000 ordinary and 300,000 preference shares of £1 each. Return dated June 5th, 1925. 245,000 ordinary and 245,000 preference shares taken up. £423,340 paid on 178,340 ordinary and 245,000 preference shares. £66,660 considered as paid on 66,660 ordinary shares. Mortgages and charges, £245,000.

John Collier & Co. (Electrical Engineers), Ltd. (174,260).—Capital, £20,000 in 12,000 "A" and 8,000 "B" shares of £1 each. Return dated October 16th, 1925. All shares taken up. £2 paid. £19,998 considered as paid. Mortgages and charges, nil.

Baynes Electrical Co., Ltd. (176,835).—Capital, £2,000 in £1 shares. Return dated October 26th, 1925. 213 shares taken up. £213 paid. Mortgages and charges, nil.

Edward Dewhurst, Ltd. (177,199).—Capital, £20,000 in £1 shares. Return dated September 7th, 1925. 15,672 shares taken up. £1,502 paid. £14,170 considered as paid. Mortgages and charges, nil.

Ayling & Co., Ltd.—Debenture dated October 23rd, 1925, to secure £900, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: J. W. Heaps, 12, London Road, Clapton, E.5.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

Electric Supply Co. of Victoria, Ltd.

The directors' report for the year ended March 31st last, shows a gross profit of £50,020 as compared with £42,999 in the preceding year. After providing for taxation and reserve for premium on debenture stock, there was a balance to the credit of the profit and loss account of £42,333. To this was added £59,142 brought forward, making £101,475. Debenture and note interest, &c., absorbed £25,105, and it was proposed to deal with the balance (£76,370) as follows:—Writing off preliminary and formation expenses, £8,757; preference dividend for the year, £10,500; dividend of 10 per cent. on the ordinary capital, £12,500; carried forward, £44,613. The additional generating sets referred to in the last report have been installed at Ballarat and Bendigo, but they only came into full operation in January last. The electricity department recorded a growth in business, but the tramway department showed a decrease in the number of passengers carried. The meeting was held on November 12th.

India Rubber, Gutta Percha, and Telegraph Works Co., Ltd.

In their report for the year ended August 31st, 1925, the directors submit accounts showing, after making provision for doubtful debts and income tax, a net profit of £108,482, plus £21,975 brought forward, making £130,457. The preference dividend absorbs £12,500 and £60,000 is to be added to reserve fund, leaving a disposable balance of £57,957, out of which a dividend of 5 per cent., free of income tax, on the ordinary shares, is to be paid, leaving £20,457 to be carried forward. The improvement in the company's activities referred to in the last annual report continues, and the turnover of the year shows a steady and profitable increase. The work of the Submarine Cable Department and of the company's cable steamer, *Silvergray*, discloses a gratifying increase during the past year. The French factory, notwithstanding the difficulties referred to last year, has produced better results. There is reason for hoping that the improvement will continue. The reserve fund has been increased by £60,000 to £280,000. The directors have considered the desire expressed by shareholders at the last meeting, and have arranged that the warrants for the dividend on ordinary shares shall be payable on December 1st instead of January 1st. Annual meeting: November 26th.

New Issues.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—The company is offering to its shareholders an issue of 550,000 ordinary shares of £1 each at par. The new shares are being allotted in the proportion of one to each six preference or ordinary shares held. They will rank for dividend as from January 1st, 1926. In the circular containing the offer, the company states that there has been a remarkable expansion in its domestic load. During 1924 3,200 new customers were added and a further 5,000 will be connected before the end of the current year. It is anticipated that no fewer than 12,000 new connections will be made next year. The same dividend as last year will no doubt be paid for 1925.

British Insulated and Helsby Cables, Ltd.—The directors propose to capitalise the sum of £333,333 from the reserves and distribute this in the form of ordinary shares to the present ordinary shareholders in the proportion of one new share to each three held. If this proposal is approved, the new shares will rank for the forthcoming final dividend.

Prospectuses.—*Auckland Electric Power Board.*—An issue of 2,500 debentures of £100 each was offered by the Board last week, and letters of allotment have been posted. The price of issue was £98 and the debentures bear interest at the rate of 5 per cent., and are redeemable in 1946 at par. Redemption will be provided for by a sinking fund, and the Board is empowered to raise a special rate, if necessary, to secure the debentures. The proceeds are, in the words of the prospectus, "to provide funds for water-power conversion and general extension purposes in connection with the Board's electricity undertaking in and around the City of Auckland."

Government of Tasmania.—An issue of £600,000 of 5 per cent. registered stock at £98 per cent. was offered early this week by the Government of Tasmania. The proceeds are required for hydro-electric and other public works. The principal is repayable at par in 1975, or, at the option of the Government, at three months' notice, in 1945. The interest will be free of Tasmanian taxes.

Lancashire Electric Light & Power Co., Ltd.—On Wednesday last this company issued a prospectus offering 187,500 seven per cent. cumulative participating preference shares of £1 each at 23s. 6d. per share, and 371,440 ordinary shares of £1 each at 22s. 6d. per share. The proceeds are to be devoted to the repayment of moneys borrowed and expended on the development of the company's system, including the Padiham station and the installation of transmission lines, &c.

Companies to be Struck off the Register.—The names of the undermentioned companies will be struck off the Register at the expiration of three months unless cause is shown to the contrary:—

Anode, Ltd.
Boulton Magnetos, Ltd.
British East Africa Power Development Co., Ltd.
Central Electric (Handsworth), Ltd.
Christian Bergh Electric Co., Ltd.
Hightensite, Ltd.
Lightning Valve Co., Ltd.
Metallic Electrodes, Ltd.
Scott Electrical Co., Ltd.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

South-Eastern Power and Light Co.—$13,668,900 6 per cent. gold debentures, series "A" (bearer) (temporary certificates); 273,378 option warrants to purchase new common stock at $50 per share.

Application has been made to the Committee to allow the following to be officially quoted:—

Shawinigan Water and Power Co.—$2,000,000 capital stock.

German Loan in America.—Last week the Rhenish-Westphalian Electricity Works Co. offered in New York $10,000,000 of direct mortgage 7 per cent. gold bonds, due 1950, at 94. It is reported that the loan was immediately oversubscribed.

Dorman, Long & Co., Ltd.—In declaring a dividend on the 6 per cent. cumulative preference shares for the six months ending December 31st next, the directors state that no dividends are to be paid on the 8 per cent. non-cumulative preferred ordinary and the ordinary shares.

Associated Gas and Electric Co.—The report for 1924 shows a net income of $1,005,757, and after deducting preferred dividends, fixed charges, &c., there was a surplus of $186,079. Material extensions have been made in the areas in which the subsidiary companies operate.

Adelaide Electric Supply Co., Ltd.—A final dividend of 6 per cent., free of tax, has been declared on the ordinary shares, making 12 per cent., free of tax, for the year ended August 31st last, as in 1923-24.

British Electric Traction Co., Ltd.—Interim dividends of 3 per cent. on the 6 per cent. preference stock and of 3 per cent. on the ordinary stock have been declared. Last year's interim ordinary dividend was 2 per cent.

British Thomson-Houston Co., Ltd.—Dividend on the 7 per cent. cumulative preference share capital of this company for the half year ending December 15th, 1925, less income tax at 4s. in the £.

Stocks and Shares.

MONDAY EVENING.

IN most markets of the Stock Exchange, business is much quieter than it has been of late. The remarkable rush of new issues, not only of rubber companies, but in other sections as well, tends to absorb a good deal of the floating supply of capital, though it exercises at present but little effect upon prices of existing stocks and shares. In the electricity departments, material strength is shown by most of the leading shares, and the recent outburst of strength amongst the issues of the equipment companies, cable and electrical, has not caused any particular selling on behalf of shareholders who must now have very substantial profits.

The Bournemouth & Poole company is making a curious offer to its shareholders in the shape of shares in the Richmond Electric Supply Co., Ltd. The curiosity of the offer lies in the manner of its making, and it is obvious that very careful thought has been given to the manner of effecting a distribution of shares in a way that shall be the most economical to proprietors in the companies concerned. Holders of Bournemouth & Poole should on no account miss the opportunity thus offered them for acquiring shares in a go-ahead concern, and at a price which is decidedly tempting. Bournemouth & Poole have risen to 3 ex rights and no doubt the issue of the Richmond shares affords the explanation for the advancing tendency of Bournemouths which has been a feature for the past few weeks. The Richmonds are offered at 24s., and the price is 6s. 9d. premium on the top of this.

In the London group, Chelseas are better at 2 and Kensingtons at 13. Edmundsons ordinary strengthened to 23s. 6d. Midland Counties, which have been quiet for some time past, are better at 22s. 9d. The Lancashire Light & Power Company is making a new issue this week of 7 per cent. cumulative participating preference at 23s. 6d. and of ordinary at 22s. 6d. Here, again, shareholders should see to it that they take advantage of the offer made to them, for the senior shares command a higher price in the market than that at which the new shares are offered, and the latter will be saleable at a premium.

The Hendon Electricity Supply Company is reorganising its capital and offers three new ordinary shares, for every ten held, at 46s. each. The present price of the existing shares is nearly £3. After this offer is completed, the company will make a bonus share distribution of 30 per cent., and the fortunate proprietors are to be congratulated upon the manner in which their company has been conducted to such a high state of prosperity.

The railway market is better, with Districts a feature of strength at 48, being 2 points up on the week. Underground Electric shares have been in demand, and, although the ordinary slipped back to 2⅞ after touching 2¾, the 1s. shares at 8s. show a gain of a shilling. There is talk, very vague at present, of the long-expected reorganisation of the company's capital. When this is taken in hand, it is expected that some scheme will be formulated whereby both classes of shares may be brought within reasonable sight of a dividend.

The Siemens announcement of an interim dividend of 2½ per cent. led to some disappointment, for many people had been expecting at least 3¾ per cent. The price dropped abruptly to 33s., recovering later, however, to 34s. 6d., at which it shows a shilling fall on balance. The India Rubber Company has declared a dividend of 5 per cent., which also comes as a disappointment, but the company's increased profit figures are good enough to justify the anticipation that next year's report will show improvement in the dividend. The directors could have paid more this time, but have elected to fortify reserves at the expense of immediate return to proprietors. Brush rose 1s. to 25s. 6d., and Cromptons are 1/16 up at 13s. 9d. Electric Construction advanced to 34s. 6d. English Electrics at 20s. 3d. have risen to a slight premium, and Metropolitan-Vickers are better at 26s. 3d., on the announcement of important new contracts having been secured by the company. British Insulated fell back to 3¾, after their recent very sharp rise. The rest of the shares in this division hold their ground.

New issue success is not confined to rubber companies. Auckland Electric Power Board offered 5 per cent. 1946 stock at 98, and the lists closed in a couple of hours from their being opened. In New York, prompt subscription followed upon an issue of ten million dollars Rhine Westphalia Electric Power 7 per cent. gold bonds at 94 plus interest. In contradistinction to these, it may be mentioned that the irrepressible Southern Counties Electric Light & Power Supply Company announces that the "subscription list is now open" for its preference, ordinary and debentures. The ordinary shares, by the way, are of the nominal value of a shilling, but are offered at 6s. Presumably there must be some people so simple as to apply for Southern Counties Electric descriptions, otherwise the things would not be pushed so persistently.

British Electric Traction went back a point, to 122½, although the interim dividend of 3 per cent. is 1 per cent. better than that of a year ago. Anglo-Argentine Tramways are better: Brazilian Tractions reacted. Mexicans remain rather irregular.

Cable stocks of the Eastern group display a robust tendency. Eastern ordinary, Eastern Extensions, and Westerns have strengthened. Globes hold their rise. Automatic Telephones are better at 51s. 3d., and International Automatics enjoyed a brisk jump to 33s. 6d. On the other hand, wireless shares are dull. Marconis have weakened to 26s. 3d. Two directors resigned last week, and their places are taken by Sir Frederick Barthorpe, D.L., and Sir William Slingo. It will be remembered that Sir William was engineer-in-chief of the G.P.O. during 1912-1919. Radio common gave way to 9¾ and the preferred to 9¼, following upon sales of shares induced by publication of the financial results of last quarter. Canadian Marconis drooped to 6s. 3d. It is semi-officially stated that there is no question of an amalgamation between the Canadian Marconi and the Radio Corporation of America.

With a fresh jump, raw rubber soared to 4s. 6d. per lb., revitalising the rubber share market and drawing fresh attention to the dividend possibilities that this price presages for shares in well-managed rubber companies. Other industrial sections are steady in the main. Babcocks keep hard at 51s. 3d., being regarded as one member of the quartette of sound iron and steel companies which are bound to benefit from any revival in the country's heavy trade.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom. £	Dividend. 1923.	Dividend. 1924.	Price Nov. 16. 1925.	Rise or fall.	Yield p.c.
Bournemouth and Poole	1	13	14	9xr	+ ⅛	4 13 4
Brompton Ordinary	1	10	10	11¾	—	*5 14 8
Charing Cross Ordinary	1	14½	15	20/-	—	6 2 5
do. do. 4½ Pref.	1	4	4½	17/6	—	5 2 10
Chelsea	1	12	12	2	+ ⅛	6 0 0
City of London	1	15	15	47/-	—	6 7 4
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	27/6	—	5 16 4
County of London	1	15	15	57/-	—	5 5 2
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Edmundson's Ordinary	1	7	7	23/6	+1/-	5 19 2
do. 7% Pref.	1	6	7	21/6	—	6 10 2
Elec. Supply Corporation	1	10	10	32/6	—	6 3 0
Kensington Ordinary	5	14	15	13	+ ⅛	5 15 5
Lancs. Light and Power	1	7½	7½	26/6	—	5 13 2
London Electric	1	10	10	34/-	—	5 17 8
do. do. 6% Pref.	5	6	6	5⅝	—	5 6 8
Metropolitan	1	10	11	38/6	—	5 14 4
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	5½	6	22/9	+6d.	5 5 6
Newcastle-on-Tyne Ordinary	1	6	7	22/6	—	6 4 5
do. 5% Pref.	1	5	5	18/9	—	5 6 8
do. 7% Pref.	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6% Pref.	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	5	17½	17½	15	—	5 16 8
South London	1	15	15	2½	—	12 6 0 0
South Metropolitan Pref.	1	7	7	1¼	—	5 12 0
Urban Ordinary	1	4	4	18/3	—	4 7 8
do. 6% Pref.	1	6	6	18/9	—	6 8 1
Westminster Ordinary	1	15	15	44/6	—	6 14 10
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	1	—	7 10 0
Yorkshire Elec.	1	8	8	29/6	—	5 8 6

Home Rails.

Central London Ord. Assented	Stock	4	4	67	—	5 19 5
Metropolitan	,,	4	5	71	—	7 0 10
do. District	,,	3½	3½	48	+2	7 6 10
Underground Electric Ordinary	10	Nil	Nil	2¾	— ⅛	Nil
do. do. "A"	1/-	Nil	Nil	8/-	+1/-	Nil
do. do. Income	Bonds	6	6	97	—	*6 3 9

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	103	—	5 16 6
do. Def.	,,	1½	1½	24⅜	—	6 3 1
Automatic Telephone	1	3	6	2⅞	+ 1/16	2 6 10
Chili Telephone	5	6	5	6⅛	—	*4 7 0
Cuba Sub. Ord.	10	5	5	6¾	—	7 8 2
Eastern Extension	10	10	12	18¾	+ ¼	*5 9 7
Eastern Tel. Ord.	Stock	10	10	180	+1½	*5 11 1
Globe Tel. and T. Ord.	10	10	10	12½	—	*5 9 7
do. do. Pref.	10	6	6	11	—	5 8 1
Great Northern Tel.	10	22	22	34½	— ½	6 8 6
Indo-European	25	7	8½	45½	—	*4 13 5
Marconi	1	10	10	1⅛	— 1/16	7 12 4
Marconi Marine	1	10	7½	⅝	—	8 11 6
Oriental Telephone Ord.	1	12	12	42/-	-6d.	*5 14 3
United R. Plate Tel.	5	8	8	7⅞	— 1/16	5 5 10
Western Telegraph	10	10	10	17⅜	+ ⅛	*5 13 6

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref.	5	5½	5½	3½	+ 1/16	7 17 2
do. do. 2nd Pref.	5	6	6	3⅞	+ 1/16	8 14 6
do. do. 5% Deb.	Stock	5	5	77	—1½	6 9 10
British Electric Traction Ord.	,,	6	6	122½	—1	4 18 0
do. do. 6% Pref.	,,	6	6	106	—1	5 13 2
Brazil Traction	100	4	4	79	—1	5 1 3
Brit. Columbia Elec. Rly. Pcs.	Stock	5	5	89½	—	5 11 9
do. do. Preferred	,,	96/-	96/-	98½	—	*4 17 6
do. do. Deferred	,,	129/5	129/5	116½	—	*5 11 0
do. do. Deb.	,,	4½	4½	77⅛	—	5 9 8
Lond. & Sub. Trac. 5% Pref.	1	2½	Nil	4/6	—	Nil
London United Tram. Deb.	Stock	4	4	42½	—	9 8
Mexico Trams, 5% Bonds	—	5	5	63½	—	7 17 6
Mexican Light Common	100	Nil	Nil	31	+2	Nil
do. Pref.	100	Nil	Nil	£4	—	Nil
do. 1st Bonds	—	5	5	69½	—1	7 3 11
Yorkshire (West Riding)	1	5	—	18/9	—	5 6 8

Manufacturing Companies.

Babcock & Wilcox	1	12	12	2⅝	—	*4 13 7
British Aluminium Ord.	1	5	10	1¼	—	5 6 8
British Elec. Transformer Pref.	1	Nil	7	1	—	... ...
British Insulated Ord.	1	15	15	3¾	— ⅛	4 2 9
Brush Ord.	1	10	10	25/6	+1/-	7 16 11
Callenders	1	15	15	3¾	—	4 9 0
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	13/9	+1/8	... ...
Edison-Swan	4/-	10	10	9/-	—	4 9 0
do. 5% Deb.	Stock	5	5	84	—	5 19 1
Electric Construction	1	10	10	34/6	+9d.	5 15 11
Enfield Cable, Pref.	1	7½	7½	1¼	—	6 0 0
English Electric	1	5	5	20/3	+9d.	4 19 0
do. do. Pref.	1	6	6	21/-	—	5 14 3
Gen. Elec. Pref.	1	6¼	6¼	23/9	—	5 9 5
do. Ord.	1	5	7½	29/9	+1/8	5 0 10
Henley	1	15	16	3⅛	—	4 10 5
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	5	1¼	—	*4 9 0
Johnson & Phillips	1	10	10	59/3	—	5 7 7
Met-Vickers, Ord.	1	8	8	26/3	+1/3	6 1 11
do. Pref.	2	8	8	23	—	6 14 9
Siemens Ord.	—	—	7½	34/6	—1/-	4 6 11
Telegraph Construction	12	20	20	26½	—	4 10 0

* Dividends paid free of Income Tax.

Exports and Imports of Electrical Goods and Machinery in October, 1925.

A LARGE decline in the value of exported submarine telegraph and telephone cable (£411,820) was again responsible for a reduction in the total value of electrical exports during October. The fall as compared with the September figures was £172,761. Upon the whole, the position improved, for apart from the submarine-cable decrease, all items, with three minor exceptions, showed satisfactory increases. The principal actual improvement occurred in the case of unenumerated electrical machinery, the value of which rose by £89,076. Insulated wires and cables also made an appreciably better showing, being £51,054 above the September figures, and exported telegraph and telephone instruments and apparatus increased in value by £25,524. The best proportional increase was recorded for railway and tramway motors, £16,869. Comparing the figures with those for October, 1924, it is seen that the fall in submarine telegraph and telephone cable was responsible for the bulk of the decline in the total, although other items made large contributions: for instance, "other motors and generators," and telegraph and telephone instruments and apparatus. The only important increases upon the October, 1924, figures occurred in the cases of unenumerated electrical machinery, insulated wires and cables, and glow lamps.

Turning to the import section, it will be observed that only two items were lower in value than in the previous month; unenumerated electrical machinery fell heavily, being almost halved in value. The increases were roughly proportional, unenumerated electrical goods, telegraph and telephone apparatus, and batteries and accumulators being the outstanding items. The rise from the October, 1924, figures was fairly general, although batteries and accumulators were prominent in the list, with an increase of £50,513. The only items which declined to any extent were telegraph and telephone apparatus and unenumerated electrical machinery.

While the re-exports rose in value by £7,248 as compared with the September figures, they were £2,755 lower than in October, 1924. In this section, also, batteries and accumulators showed an increase. This is probably a manifestation of radio activity in preparation for the ensuing winter.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Oct., 1925.	Inc. or dec. as compared with Sept., 1925.	Inc. or dec. as compared with Oct., 1924.	Electrical imports for Oct., 1925.	Inc. or dec. as compared with Sept., 1925.	Inc. or dec. as compared with Oct., 1924.	Electrical re-exports for Oct., 1925.	Inc. or dec. as compared with Sept., 1925.	Inc. or dec. as compared with Oct., 1924.
Electrical goods and apparatus (unenumerated)	£178,795	+ £9,777	− £23,987	£116,987	+ £30,548	+ £17,271	£8,630	+ £2,648	− £1,711
Insulated wires and cables ...	231,345	+ 51,054	+ 44,786	69,246	+ 18,026	+ 19,661	804	− 163	− 503
Glow lamps	50,547	+ 16,288	+ 15,219	33,681	+ 4,879	− 6,169	520	+ 247	+ 130
Arc lamps and parts	1,074	− 78	− 60	3,574	+ 1,568	+ 2,257	25	− 65	− 55
Batteries and accumulators ...	74,107	+ 9,711	+ 5,594	96,189	+ 26,552	+ 50,513	1,947	+ 1,588	+ 1,743
Meters and instruments ...	35,262	+ 11,801	+ 1,901	23,975	+ 1,311	+ 8,686	587	− 4	− 64
Carbons	645	− 450	+ 367	10,846	+ 3,186	+ 3,635	138	− 54	− 120
Electrical Machinery—									
Electrical machinery (unenumerated)	264,422	+ 89,076	+ 74,806	65,608	− 31,594	− 12,474	6,774	+ 2,402	− 438
Railway and tramway motors	39,409	+ 16,869	− 23,273	—	—	—	—	—	—
Other motors and generators ...	186,811	+ 8,428	− 93,853	—	—	—	—	—	—
Switchboards (not telegraph or telephone)	8,494	+ 3,175	+ 1,199	353	+ 326	+ 116	—	—	− 585
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	50,571	− 2,116	− 23,171	13,953	− 4,281	+ 1,367	—	− 574	− 273
Submarine telegraph and telephone cable	15,093	− 411,820	− 119,476	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus ...	228,907	+ 25,524	− 82,469	81,130	+ 31,728	− 23,303	3,619	+ 1,203	− 419
Totals	£1,363,482	− £172,761	− £222,748	£515,542	+ £82,249	+ £61,560	£23,044	+ £7,248	− £2,755
Increases for the ten months ended October, 1925...		Exports. + £2,065,720			Imports. + £928,913			Re-exports. + £35,505	

The Trade Position in Greece.

ACCORDING to a report by Mr. R. F. H. Duke, C.B.E., British Commercial Secretary at Athens (Stationery Office, 2s. net), the establishment of Parliamentary Government in Greece has led to a remarkable change, and the year 1924 may almost be regarded as a milestone in the economic development of the country.

As regards British trade, the situation has shown some improvement. The Government is beginning to realise the desirability of facilitating the investment of foreign capital in Greece and the co-operation of British industry in the development of the country. British firms have shown greater interest than was the case during the previous few years in Government contracts, both of a military and civil nature, and in public enterprises generally in Greece. There is no doubt that the Greek Government is most anxious to develop the country, and that many schemes of a productive nature can be undertaken with profit. The numerous public works schemes which were contemplated in 1921 and 1922 did not make much progress in 1923. The proposal of an American group to carry out irrigation drainage, hydraulic power and railway development did not reach a concrete stage. Tenders were invited for the exploitation of the Vladovo Falls on the river Vodo, to supply electric power to Salonika, but the scheme did not come to fruition. Recently proposals were submitted by a British group for the re-organisation of the electric light and power system of Athens and Piræus, including the extension of the Athens-Kephissia and Athens-Piræus railways, and to the Athens and Piræus tramway systems, involving an expenditure of some 3 million pounds. If the British firm is successful in carrying the scheme through, it should add very largely to British industrial prestige in Greece, and bring considerable employment to the engineering and electrical industries in Great Britain. The tender for the electrical distribution and the construction of tramways at Canea has been constantly postponed, and no decision has yet been taken.

The postal and telephone services are stated to be entirely inadequate. A British group in 1923 put forward a scheme for the installation and exploitation of an automatic telephone system which appeared to have prospects of success, but eventually the scheme was withdrawn and nothing more has been heard of it. Further invitation to tender for the supply of certain quantities of apparatus was issued in February last, but no decision has yet been reached. The telegraph service remains quite efficient, but proposals for the installation of general radio services have made no progress, and although a contract was signed between the Greek Government and the Marconi Co. in November, 1923, it has not yet been ratified.

The report recommends British firms to co-operate with merchants or capitalists of high standing in Greece. The complications of contract work, especially with the Greek Government, are such that without the assistance and advice of experienced Greek collaborators, foreign firms can hardly expect either to meet with success.

American Production and Prosperity.

A F.B.I. Report upon the United States.

Col. the Hon. F. Vernon Willey and Mr. Guy Locock, who recently paid a visit to the United States on behalf of the Federation of British Industries, have prepared a report containing a concise review of the factors operating in that country to-day. With regard to the prosperity of the United States it is mentioned that although the population is only 6.2 per cent. of the total population of the world, America produces 71.9 per cent. of the world's petroleum; 70.9 per cent. of the rubber; 60.2 per cent. of the pig iron; 52.7 per cent. of the copper; 57.8 per cent. of the telephone and telegraph material; and 82.7 per cent. of the automobiles.

It is stated that the general trend of business is highly satisfactory, and there is no indication of any slackening in the volume of trade. It is expected that next year will see all records broken, and that a prolonged period of prosperity is in front of the United States. Among the industries particularly mentioned in the report is the iron and steel industry, production in which took an upward turn in August this year. The weather has been generally favourable to the crops, and the prices obtained for agricultural produce are an important factor in the strength of the country's position.

As regards American production, it is reported that partly as a result of the war, enormous plant developments took place, and when the slump came there was widespread overcapacity. A remarkable recovery has been made towards maximum output. Whereas in 1921 the actual output was only 57 per cent. of the productive capacity, in 1923—the latest year for which figures are available—the ratio had risen to 71.8 per cent. and it is believed that since 1923 further progress has been made towards maximum output.

The financial position of the United States is undoubtedly sound, and the banking system established by the Federal Reserve Act has thoroughly justified itself. The position of banks and of industrial corporations is extremely liquid, due mainly to two causes; first, there is now comparatively little capital expenditure on plant, and, secondly, the financial burden of carrying large stocks has been greatly reduced owing to the policy of "hand-to-mouth" buying and direct sales to the consumer. The accumulated wealth of the United States is so great that the country will be driven by the force of circumstances, to follow increasingly a foreign investment policy. A table in the report shows that the United States investment in foreign countries was 1,445 million dollars in 1920—a phenomenal figure. In 1923 it had fallen to 444 million dollars, and in 1924 a rise to 959 million dollars was experienced. The most important American foreign investments are in the Latin-American countries, with Canada and Newfoundland second. So far as Europe is concerned, money has of late tended to flow towards government and municipal issues rather than towards productive enterprises, but the investigators believe that this point is not being lost sight of by American financial interests.

The domestic investment situation in the United States is remarkable for, first, the immense appreciation that has occurred in capital values, which it is considered is likely to be maintained; and secondly, enormous profits are being made in land deals. The increased capital values necessitate increased earnings. Normally it would have been expected that the influx of gold into the United States would have tended to raise prices substantially, but this has not been the case, as the producer found that if he raised his prices he would not be able to sell his products. This failure of American prices to rise, as predicted, is all the more remarkable in view of the enormous extension of the deferred payment system. The underlying explanation of this phenomenon is generally stated to be that the increasing efficiency of production in the United States has stopped a rise in price level, and that producers are holding their position by means of lower percentage profits and greatly increased output.

With regard to taxation, the report states that although it is difficult to accurately compare conditions in this country and the United States, it is probably right to say that American taxation is not more than 60 per cent. of the British, and a considerable reduction in Federal taxation is certain at the end of the present financial year, owing to the substantial surplus which will be shown. It is stated that although the volume of production has increased from an index figure of 200 in 1921 to 285 in 1923, the number of wage earners has only increased from an index figure of 150 in 1921 to 190 in 1923. These figures show clearly the increased output per head, and the improved utilisation of power resources, and are a striking tribute to the efficiency of American production. In the last 10 years the volume of railway freight has increased by 25 per cent., while the number of employés has remained stationary. The reasons generally given for this increased efficiency are (1) the spread of education, both general and technical; and (2) the labour situation, the salient points of which are restriction of immigration, high wages, unrestricted output and the utilisation of labour-saving devices, and the satisfactory relations between employers and employed. The American employer believes in high wages and he pays them. But he also believes in high output, and he sees that he gets it.

Industrial organisation has attained a pitch in the United States which has never been equalled in any other country, with the possible exception of Germany. In individual business the tendency is towards the large unit. This tendency is likely to become more and more marked. Apart from this movement towards amalgamation, there is far more readiness in America than in Great Britain for the different firms in one industry to co-operate for their mutual good, and even to go so far as to pool a great deal of their technical experience. The capacity and efficiency of American production are so great that sooner or later the country must domestically reach the saturation point, and there is no doubt that as time goes on the United States will become increasingly a factor in world trade, and we shall meet with increasingly severe competition from it. There can be no doubt that as soon as the moment comes that foreign trade development on a large scale is a necessity, a nation of such initiative, energy and organising power, will build up a foreign trade system which will rival our own. Whereas Great Britain is the greatest user of American goods, she is only fourth in the list of supplying countries, in which the first place is taken by Canada, the second by Cuba, the third by Japan, and the fifth by Brazil. A regrettable tendency during recent years has been the falling off in the re-export trade from Great Britain to America, which is now buying direct from foreign countries to a much greater extent. The future trend of the American tariff has of course an important bearing upon our trade with the United States. On the whole it may be said that there would be strong opposition to any further increase in the tariff, but it is unlikely that there will be a revision downwards.

There is unfortunately a general impression in the United States that England is definitely "down and out." All our difficulties are exaggerated, and the progress that we have made towards re-construction is ignored. Not only is this doing the prestige of Great Britain infinite harm, but it is also losing us business. The report earnestly urges that some concerted steps should be taken to bring the real facts before the American public. It is thought desirable that one or more Englishmen of high standing should take an early opportunity of visiting the United States, and in a series of speeches in different parts of the country should correct the harm which has been done to British industries. It is suggested that the F.B.I. should take the initiative in this matter.

The Electrically-driven U.S.S. "Lexington."—The second of the United States Navy's new airplane carriers, the U.S.S. *Lexington*, was launched on October 3rd, at the Fore River plant of the Bethlehem Shipbuilding Corporation in Quincy, Mass. As in the case of the U.S.S. *Saratoga*, of which this boat is a duplicate, the *Lexington* is one of the largest ships ever launched in the western hemisphere, and will excel the first line battleships of this country in propulsion power. This will be the third United States airplane carrier; the only one now in service is the *Langley*, which ship was rebuilt from the old collier, *Jupiter*, the first vessel of the navy to be equipped with the turbo-electric drive. The *Saratoga*, launched this spring at Camden, N.J., is not yet in service; originally, both the *Saratoga* and *Lexington* were to have been battle cruisers, but the modification of the American naval programme, due to the decisions reached at the conference on the limitation of armaments, led to the conversion of these battle cruisers into airplane carriers. As a naval vessel, the *Lexington* (with the exception of her twin, the *Saratoga*) is the longest in the world; her length is 874 ft. and beam 105 ft. The output of the electric generating equipment is 180,000 h.p.—greater than the combined rated output of the six electrically-driven capital ships now in commission, *viz.*, the *New Mexico*, *California*, *Tennessee*, *Maryland*, *Colorado*, and *West Virginia*.

The complete electrical equipment for the *Lexington*, as in the case of the *Saratoga*, was furnished by the General Electric Co., of America. The propulsion apparatus consists of four 35,200-kW turbo-generators, supplying current to eight 22,500-h.p. motors. The turbines are operated with steam supplied by 16 oil-fired boilers. The motors are connected in pairs to each of the four propeller shafts, the total energy thus delivered to each shaft being 45,000 h.p.—sufficient to turn the propeller blades at a rate of 317 r.p.m., and to propel the ship at the rate of 33 knots, or approximately 39 miles an hour. In addition to the propulsion machinery, there are six 750-kW, direct-current, auxiliary turbo-generators which furnish current for all electrical purposes, except main propulsion. Among other uses to which electricity is put is the operation of the steering gear, anchor windlass, ventilation fans, and lighting systems. As in the case of the *Langley* and *Saratoga*, the *Lexington* is completely and specially equipped for radio work. The antenna runs to the deck from a single topmast, which has to be lowered when the boat passes under the Brooklyn Bridge.

A Remarkable High-Frequency Cable.

Inductance Coils made with Multi-Wire Cable.

AMONG the features of the Government's great radio station at Rugby is a cable of novel construction which forms part of a variable inductance in the high-power radio-frequency communication circuits. Generally speaking, the cable may be

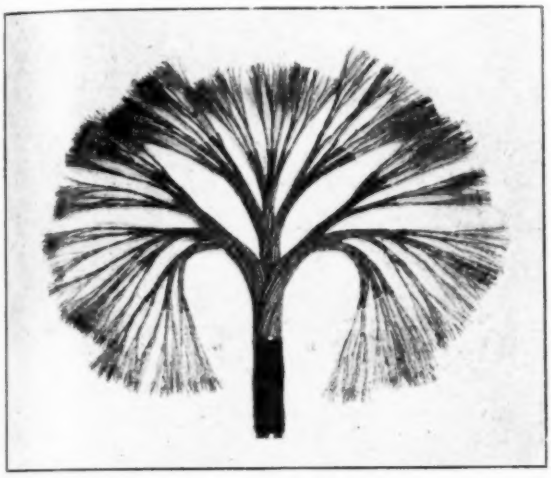

Fig. 1.—The 6,561-wire High-frequency Cable.

compared with the single wire which is wound into a coil for tuning and is familiar even to the wireless tyro.

The cable in these giant inductance coils contains 6,561 wires, each separately insulated with enamel, and connected together at each end to form what is, to all intents and purposes, one conductor, *i.e.*, all the wires are in parallel. The reason for the separate insulation of each fine wire in the con-

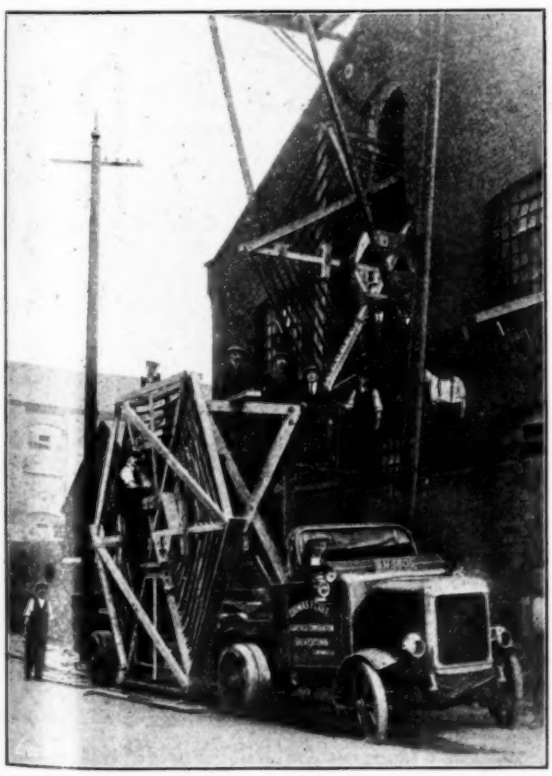

Fig. 2.—Cable and "Spiders" being removed from Works.

ductor is the alternating-current "skin" effect, as it was called, which becomes of importance when the frequency reaches many thousands of cycles per second, as it does in wireless transmission.

The cable has two characteristics: The first is that, considered as a conductor, it is divided into a number of separate elements or wires, and the second is that the wires are plaited together in such a way that every wire over a given length passes through the same phases as every other wire with regard to the neutral axis, so that there is no tendency for a greater retardation, or impedance due to the high frequency, on any one wire more than another. The wires in an ordinary electric cable, although rotating around the axis, always remain at the same radial distance from the axis. In this unique inductance cable, owing to the different distances from the axis of the various wires from point to point, slight differences of potential are generated. If all the wires were bare, there would be short circuiting and the desired result would not be fully attained. To avoid this, the wires have been lightly insulated with enamel.

In the construction of this cable, the insulated wire was first covered with a layer of cotton to protect the enamel; three wires were then twisted together to form a unit, three of which units were next twisted again, and the operation was repeated until 81 wires had been assembled, when they were covered with a coat of silk to give further protection. Three such bunches were twisted again, and the operation repeated until the cable contained 6,561 wires.

The accompanying illustration (fig. 1) of the cable, showing the wires spread out fan wise, gives a clear idea of the construction of the cable, which was constructed in accordance

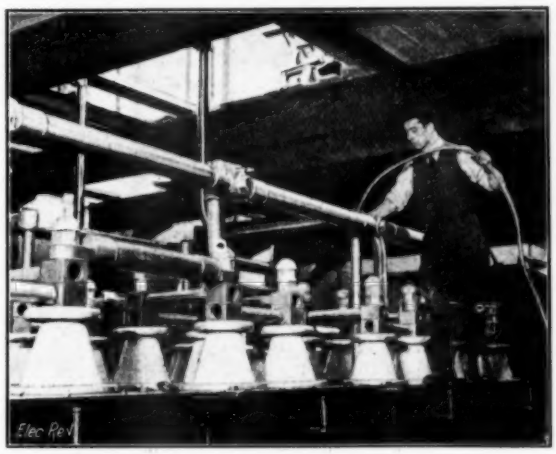

Fig. 3.—Condensers being filled with "Shell" Oil.

with the design and specifications of the British Post Office Engineering Department by W. T. Henley's Telegraph Works Co., Ltd. Its manufacture presented several unique features, which involved the design and construction of special plant and machinery.

The "spiders" shown in fig. 2 are really the complete inductance coils, the wooden framework being the former for the conductor. As they are 17 ft. in diameter, transport by rail was out of the question, and they were transported on special lorries from the manufacturers' works at North Woolwich to Rugby. The route had to be specially selected and surveyed to avoid the possibility of trouble with bridges, &c. In the second view it will be observed that the wall of the workshop had to be partly broken away to get them out. In all, nine of these huge tuning coils are to be used at Rugby.

After many years the theories of Lord Kelvin and Oliver Heaviside have thus found application in a branch of electrical development of which they were not cognisant at the time. Further, the theory and formula evolved by Lord Kelvin mathematically for frequencies of about 100 per second were experimentally proved to be correct 25 years later up to frequencies as high as 5,000 per second, and the frequencies used in wireless transmission are very much higher than this.

It has already been announced that some of the largest Dubilier condensers in the world have been installed at the Rugby radio station, and the third of the accompanying illustrations shows the condensers being filled with "K1" transformer oil supplied by Messrs. Shell-Mex, Ltd.

Lloyd's Register of Shipping.—The report of Lloyd's Register for the past year has been received. It states that the total tonnage of merchant vessels afloat holding the Society's classification is 28,436,965 tons—the highest figure recorded. Motor ships over 100 tons classified number 2,145, representing 2¼ million gross tons, and of these 19 exceed 8,000 tons; two are over 15,000 tons. The demand for double-acting Diesel engines is increasing, there being 25 sets of this type under construction; four sets of six-cylinder, two-stroke cycle, double-acting Diesel engines of 31,000 i.h.p. are being built for the quadruple-screw motor ship *Augustus* of 33,000 gross tons.

A New Design of Water Wheel.

New Jet Arrangement for Medium-Capacity Machine.

In order to meet a need which has been felt in water power work for a turbine having a capacity intermediate between the Pelton wheel and the low capacity reaction turbine, situations having been found where the Pelton wheel ran too slowly, but where the reaction turbine, with its less perfect speed regulation, and rather delicate wearing parts, was unsuitable, Messrs. Gilbert Gilkes & Co., Ltd., have designed a new impulse wheel, the "Turgo," which is claimed to maintain the simplicity of the "Pelton" type. The main difference between the two machines is that in the "Turgo" the jet makes an angle with the plane of the wheel, whereas in the "Pelton" it is directed straight on to the wheel tangentially to its circumference. This difference in the principle of the two methods is shown diagrammatically in fig. 1. The vanes or buckets can be completely enclosed at their outer periphery, allowing the water in passing over the vanes' surfaces to be completely controlled. Higher speeds can be obtained on this wheel, it is claimed, because a much larger jet can be efficiently used with a runner of given diameter. The speed regulation is accomplished by the firm's patent shaft governor.

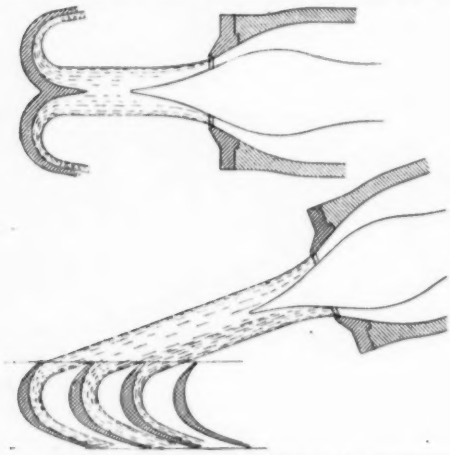

Fig. 1.—"Pelton" and "Turgo" Jet Arrangements.

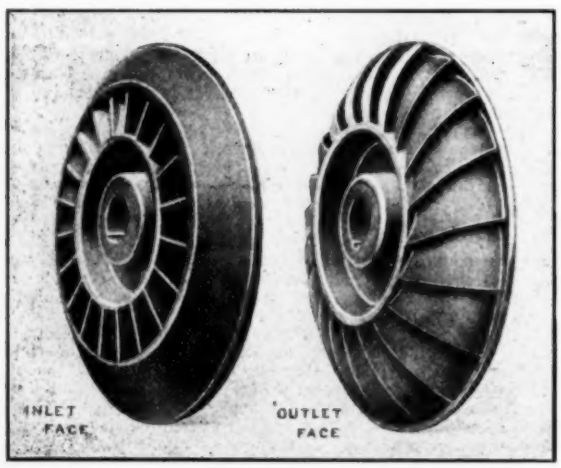

Fig. 2.—Turbine Wheel Faces.

Fig. 2 shows the inlet and outlet sides of a Turgo impulse wheel. The runner is made in one casting, and the water is directed on to the wheel in a jet of circular section through a nozzle exactly similar to that of the Pelton wheel. The plane of the jet makes a slight angle with that of the wheel, and the water enters at one side and passes out at the other. For heads up to 300 ft. the Turgo impulse wheel is standardised. The shaft is carried in ball and roller journal bearings and is located endways by means of a thrust ball bearing. The cast-iron casing is split on the horizontal centre line. Centrifugal throwers of the usual type prevent the escape of water along the shaft. In cases where no economiser is used, a hand adjustable spear rod is used to vary the size of the jet. Fig. 4 shows a complete unit fitted with a shaft governor, designed for direct coupling to an electric generator. The machine can be arranged on a vertical shaft where necessary. Fig. 3 shows a unit with the wheel exposed.

An efficiency curve prepared by Prof. A. H. Gibson, of Manchester University, from the results of tests made by him, on a 125-h.p. 18-in. wheel, shows a maximum efficiency of 80.5 per cent. at about 110 b.h.p.; the efficiency between 60 and 125 h.p. exceeds 80 per cent. and at 25 h.p. a 70 per cent. efficiency is recorded. The output of course varies with the fall of water and the size of the wheel. For an 18-in. wheel working on a 100-ft. fall the output is scheduled at 38.4 h.p., the water capacity being 260 cu. ft. per min., running at 451 r.p.m.

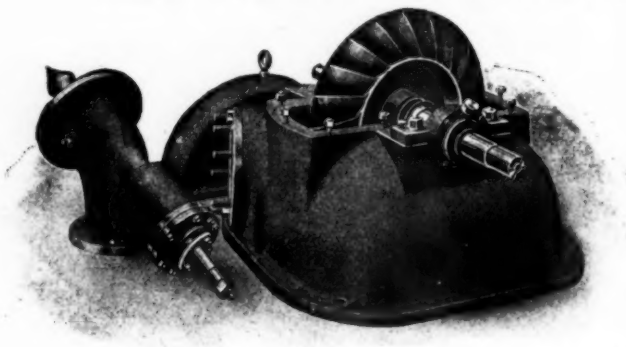

Fig. 3.—Machine with Wheel Exposed.

The Severn Barrage Scheme.—For some time little has been heard of the Severn barrage scheme, but it is gathered that, as the question of electricity supply in Great Britain is now under consideration, the Cabinet has decided that further investigations are desirable. A sub-committee of the Committee of Civil Research has accordingly, says the *Daily Telegraph*, been appointed, under the chairmanship of Lieut.-Col. Moore-Brabazon, Parliamentary Secretary to the Ministry of Transport, and the project will receive examination. It was stated in the House of Commons last May that a preliminary investigation of a very minor kind had taken place, and it confirmed the opinion of Sir John Snell that the scheme ought to be proceeded with. Lieut.-Col. Moore-Brabazon, who was speaking for the Government, said on that occasion that it was hoped "one of these days" to get a 200,000-kilowatt continuous supply out of the scheme. As regards the national electrification scheme, which is before a Cabinet Committee presided over by Sir Douglas Hogg, it is gathered that both financial details and questions of policy, such, for example, as the ownership of the proposed super-power stations, will have to be settled before a public announcement of the Government's proposals can be made.

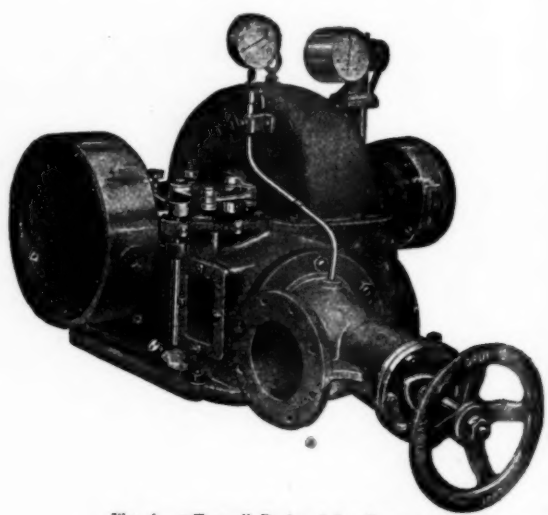

Fig. 4.—"Turgo" Designed for Generator.

Dielectric Problems in High-Voltage Cables.

By P. DUNSHEATH, O B.E., M.A., B.Sc., M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

(*Concluded from page 775.*)

HAVING examined the flow of current into an absorptive condenser under a steady unidirectional e.m.f., we will now consider what happens when such a condenser is connected to an a.c. supply.

Fundamentals of a.c. Losses.—The magnitude of the a.c. flowing (see fig. 3, last week) will depend on the current: a charging and geometric capacity; this will be a pure wattless current and comparable with that component of the d.c. ballistic capacity current associated with the charge C E (fig. 7); β flowing through the dielectric entirely by conduction or leakage, and γ into the capacity associated with absorption or the slow charging of component condensers through resistances. Only β and γ give rise to loss, the first to conduction loss and the second to what is usually styled hysteresis loss. This idea of hysteresis, based on a viscous molecular movement, seems to the author to be quite unnecessary, and by the following alternative conception, dielectric losses are considered to be due to currents flowing through circuits having definite resistances, composed in turn of an infinite number of component currents varying in phase relationship with the e.m.f. from zero to quadrature, see fig. 2. Thus a.c. dielectric losses can be considered to be I^2R losses and can be divided into non-cyclical losses, losses due to leakage, and cyclical losses due to absorption. Both presumably have the same origin, but the latter, being due to a current which flows through a condenser in series with the resistance, is thus dependent on the frequency. The value of the resistance in the second case is, of course, experimentally indeterminate.

Interpretation of a.c. dielectric losses in terms of the absorption equation $I_t = I + At^{-n}$ leads us to a definite expression for the a.c. power factor in terms of the d.c. absorption index n, from which values of cos θ have been calculated, and the results are plotted in fig. 10 to cover a usual range of power factors obtained on impregnated-paper cables. It follows from the relationship brought to light in this diagram that, *so far as the losses due to absorption* are concerned, the perfect cable dielectric is that in which the index n in the absorption equation equals unity, giving zero power factor, and the nearer this index approaches its maximum value of unity the lower will be the a.c. power factor. The conclusion receives considerable support too from the experimental results which show that the drier and cooler a dielectric the nearer n approaches unity. This is an important conclusion and illustrates the very close connection that does exist between the a.c. and d.c. characteristics of a dielectric. It suggests also a method for the determination of a.c. power factor in which only d.c. tests are applied. The total losses in a given dielectric, however, comprise not only these due to absorption, but a further source of loss due to ionisation of enclosed air. The actual power factor determined experimentally will therefore be some value in excess of that given by fig. 10 by a quantity due to this other cause.

"V" Curve for Losses and Power Factor.—A very important and interesting relationship in the study of cable dielectrics is the variation of dielectric loss with temperature. Over a working temperature-range the dielectric loss in most cables falls to a minimum at about 40 deg. C., and then rises again. The variation when plotted is the "V" curve of dielectric loss. The power factor curve is of the same shape owing to the charging currents being practically unaffected by temperature. So far no satisfactory explanation of the shape of this curve has been given.

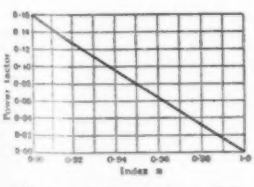

Fig. 10.—Relation between P.F. and Absorption Index.

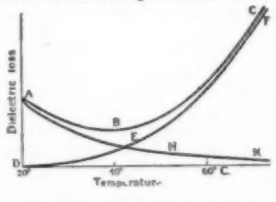

Fig. 11.—The "V" Curve Resolved into Two Components.

The I^2R theory of dielectric losses formulated to replace the hysteresis conception seems to offer a better explanation of the "V" curve. Reverting to fig. 2, we recall that the elementary power factors were in each case proportional to the assumed series resistance. Now this conducting path in a dielectric is of an electrolytic nature with a negative temperature coefficient of resistance. If the temperature be raised, the resistance falls and with it the power factor cos $\theta = \omega CR$. Both falling and rising portions are due to change of resistance with temperature. In the former case the resistance is in series with capacity, in the latter it is in parallel. The point is illustrated by fig. 11, where A B C is the curve obtained experimentally. Curve A H K is the component falling due to the decreasing resistance in series with capacities, and D E F the component attributed to direct leakage.

The author's tests embody one or two unique features illustrating the "V" curve, which may be described with advantage. In most tests high voltages are employed and, in order to explore a new field, it was decided to carry out a voltage/temperature range of loss tests at quite low voltages. The limits adopted were 50 to 110 volts, and the temperatures varied from 17 deg. C. to 85 deg. C. The dielectric losses were plotted against temperature for the different voltages, and the outstanding feature is the existence of the "V" curve. It is of considerable importance to note that it exists at such low voltages.

The shape of the "V" curve obtained from power-factor tests on a high-voltage cable may be deliberately changed by the use of different papers, impregnating compounds, and methods of manufacture. In all cases of impregnated-paper cables, where there is a minimum point in the "V" curve it seems to occur at a temperature about 30 deg. C. to 40 deg. C., but the minimum point can be eliminated entirely by certain treatment. For instance, in fig. 12 cable E was known to be imperfectly dried and the power factor, starting at an abnormally high value at normal temperature, continues to rise with temperature with no attempt at a minimum point. Cable F was impregnated under special conditions and with a special compound, both of which are known to produce a low power factor. In this case the power factor remains independent of temperature from 20 deg. C. up to 40 deg. C. and then only rises very slowly. Our present knowledge is insufficient to explain these curious variations in the "V" curve, but they may possibly be based on some peculiarity in the distribution of the elementary currents assumed in our treatment of absorption. If, for instance, the presence of moisture without actually adding direct conduction loads the system of condensers and resistances towards the conductance end of the series, the effect might be to produce a curve like E in fig. 12, or a curve like F could be produced by a "spreading" of the characteristics over the whole of the series.

Considerable light is thrown on the nature of the "V" curve by plotting the results of dielectric-loss tests taken on a length of cable at two different frequencies. While the 50-cycle loss is approximately double that at 25 cycles, at the low temperature the values run together as the temperature rises and at 150 deg. F. the loss is the same for both frequencies. As the charging current is proportional to the frequency, the power-factor curves have the opposite characteristic—they run together at the lower temperature and separate at the higher; at 50 deg. F. the leakage is negligible and at 150 deg. F. it predominates, but it will be shown in the next section that this assumption is incorrect. Notwithstanding the fact that the 25- and 50-cycle loss curves run together at the higher temperatures, it does not follow that at this temperature the loss is all direct conductance. The evidence is fairly clear that if tests were taken at much lower frequencies than 25, the two curves would separate at 150 deg. F. and for frequencies of the order of a fraction of 1 per second would separate very widely.

Connection between a.c. and d.c. Losses.—Very little information has been published on the connection between a.c. and d.c. losses in a cable dielectric; steady-current tests have been carried out on the cable referred to in the previous section and the connection between the a.c. and d.c. results have been calculated. The results obtained by comparing the d.c. tests just mentioned and the a.c. tests of the previous section taken on the same piece of cable establish several important points: First, the ratio of a.c. to d.c. losses in a paper cable at low voltages varies between wide limits (in this case from 4.350 to 12.3) depending on the temperature and the time of charging under d.c. conditions. Also the duration of the d.c. charge has a more marked effect on the ratio at low temperatures than at the higher ones.

The most important result of all is in connection with the "V" curve explanation advanced in a previous section. The view sometimes expressed that at the higher working temperatures of paper cables the greater part of the dielectric loss can be attributed to conduction based on d.c. values seems to be wrong. The results obtained in these tests indicate that at 85 deg. C., which is in excess of normal maximum cable temperatures, the a.c. loss is more than 13 times the value calculated on the d.c. conductance, even on 120-minute d.c. results. As the conductance was still falling at the end of this time the ratio of a.c. to d.c. loss at 85 deg. C., based on final conductance, must have considerably exceeded the value of 13. The results show that around 80 deg. C. by far the greater part of the 50-cycle losses are cyclical. Following up the argument of Section IV, the difference between the ordinates of the upper and lower curves represents the I^2R losses due to the absorption currents flowing through component resistances, and it seems to follow that the absorption losses have definitely in themselves the two components to produce the dipping curve.

Attempts have been made by some investigators to throw light on the relationship between a.c. and d.c. losses by determining the effect of frequency under the a.c. conditions. Addenbrooke showed that, except for frequencies of the order

of 1 or 2 cycles per second, the loss in a large number of different dielectrics was a linear function of the frequency n and that if expressed as watts = $A + Bn$ the higher class of dielectrics gave the lower values of A. The author has examined this characteristic for impregnated-paper cables at different temperatures and at two frequencies. A typical set of results is plotted in fig. 13 for a length of 3-core super-pressure cable subjected to 25- and 50-cycle loss tests while immersed in water at various temperatures from 52 deg. F. to 150 deg. F. The curves show that the characteristic noted by Addenbrooke for different dielectrics is also brought to light by temperature variation in one and the same dielectric.

Rise of Power Factor with Voltage.—"Ionisation" is believed to be due to the presence of air entrapped within the cable dielectric. The results of the low-voltage tests given in Section V show no ionisation on this cable at 110 volts. The losses for these tests plotted logarithmically against voltage justify very exactly an expression $W = PE^m$ where W = loss in watts, E = applied voltage, and P and m are constants (m is found to be equal to 2 very exactly.)

An important factor in any study of the connection between power factor and voltage is the effect of overloading a cable. The tests taken immediately after manufacture may give only a very slight rise of power factor with voltage, but if a heavy current be passed through the cable so as to cause undue heating of the dielectric and expansion of the lead, then the repeat tests carried out on the length after cooling down will give a much sharper rise.

In view of the dependence of power factor on the two variables, temperature and voltage, and the need for a quick method of comparing the results on a number of cables, the author has found it convenient to employ solid diagrams for plotting the results. Four such models are shown in fig. 14. The values of power factor at any one voltage are plotted against temperature and the curve so formed is cut out of 5-ply wood ¼ in. thick. Similar curves are produced for each of the other voltages employed in the series of tests, and when they are assembled the resulting block gives a very useful bird's-eye view of the properties of the cable. In the determinaiton of the effect of some modification in materials, or manufacture,

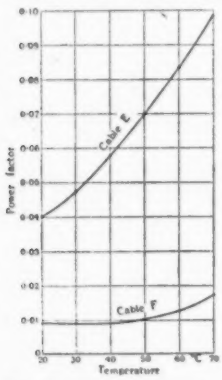

Fig. 12.—Effect of Imperfect Drying on Shapes of "V" Curve.

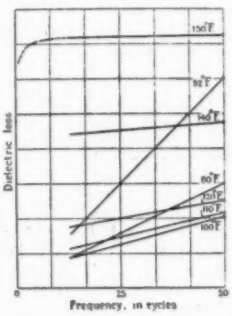

Fig. 13.—Impregnated-paper Cable; variation of Dielectric Loss with Frequency and Temperature.

when carrying out research work on cables, the comparison of two or more such blocks is much easier than the comparison of masses of figures.

Breakdown; Time-Voltage Relationship.—Quite recently the exact relationship between breakdown voltage and the time of application to the cable has called for detailed study. This time effect is quite a new phenomenon and F. M. Clark has shown that if a fibrous insulating material, such as impregnated paper, be subjected to a succession of voltage applications below the value necessary to cause failure, the dielectric being allowed considerable time for recovery between the applications, its power of resisting a straight breakdown test may be very much impaired. This means that indiscriminate high-pressure tests may seriously affect the life of the cable under working voltage, and that a succession of pressure-rises due to surges or lightning on connected open lines, although individually resulting in no failure, may make the cable progressively less able to withstand such voltages.

The author produces time/voltage curves for all cables made under research conditions by cutting a uniform length of cable into six or eight pieces, each 5 yards long, applying a quick breakdown voltage at a definite rate of increase and then applying 90, 85, 80 per cent., &c., of the value so obtained to the remaining pieces in turn. Plotting the results gives a curve that is very steep for short times and gradually flattens out until quite a small reduction in the voltage adds enormously to the time that the cable will stand up under it. As an indication of the order of the figures obtained, a good modern 33,000-volt cable will hold 75,000 volts three-phase at normal temperatures for 50 or 60 hours before failure. Instead of plotting the breakdown voltages against time the values may, as described by Owen, be plotted against the inverse fourth root of time when the points lie reasonably on straight lines. The greatest merit of this method of plotting seems to be that with it one can deduce with reasonable accuracy the probable voltage that a cable will hold indefinitely. It is evident that any precautions that can be taken to control the extent of pressure-rises on a cable system are well worth consideration.

Nature of Cable Breakdown.—Study of the conditions of individual papers taken from different parts of cables both broken down on test and subjected to prolonged pressure test, has led the author to formulate a theory of cable failure differing somewhat from those already advanced. The true explanation seems to lie somewhere between the tangential-stress theory of Höchstädter and the pyro-electric theory of Wagner.

Cables caught before actual failure in a pressure test reveal the following facts:—

(i) In a single-core cable at any point throughout the dielectric between the conductor and the lead sheath there may be a few consecutive papers showing signs of charring.

(ii) The papers above and below those damaged may be in perfect condition.

(iii) The charred condition is restricted neither to the proximity of the conductor nor to that of the lead; it may occur anywhere in the dielectric.

(iv) In a 3-core cable the same conditions hold, but, generally speaking, the charring occurs mostly on the outer core papers and either along the line of contact between cores or towards the centre of the cable.

(v) In a 3-core cable the belt papers rarely (one hestitates to say never, though this would probably be a correct word) show signs of charring.

In the earlier part of this paper it was contended that all a.c. dielectric losses are I^2R losses, the cyclical ones being due to the dissipation of energy when a current charging a condenser flows through a resistance. Now no cable dielectric is perfectly homogeneous; in a single-core cable, if the dielectric were perfect and uniform, the lines of current-flow would be

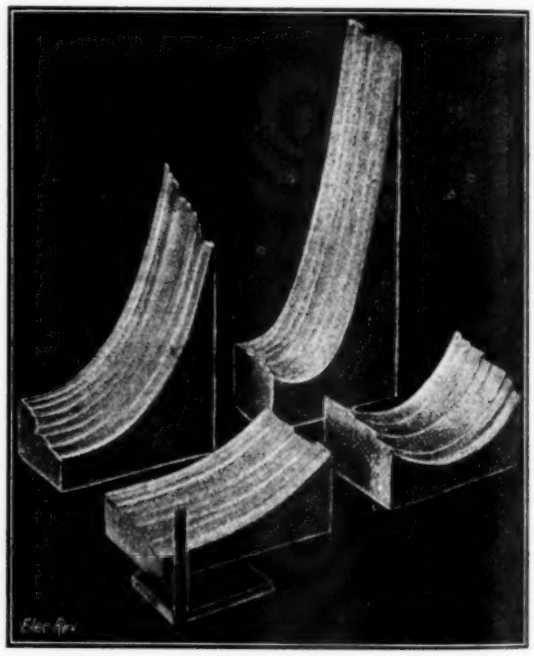

Fig. 14.—Models Recording Variation of Power Factor.

radial throughout and the current would be a pure displacement current. In a practical cable, however, we have (*a*) a layered dielectric where each layer contains paper fibres which have tiny quantities of moisture and so form electrolytic conducting paths perpendicular to the theoretical direction of the electric field; (*b*) inequalities in the contact between layers which result in a difference of impedance between one radial path and another.

Fig. 15 shows the result that may be expected from such considerations. Suppose that at point P there is a small patch where the two layers of paper are not making as efficient contact with one another as they do elsewhere. This weakness may be due to slackness of the papers, to an impervious spot in the paper preventing passage of the impregnating compound, or to imperfect drying. Whatever the cause, the result is to deflect the lines of flow of the displacement current and in so doing to turn them out of the radial direction. Immediately, the power factor of this part of the dielectric rises as the current flows along the paper fibres, energy is dissipated, and the resulting heat chars the papers and compound.

Further supporting evidence for this theory is given by the shapes of charred holes in single-core cable breakdowns. They frequently emerge on the outer surface in a direction oblique to the radius, as at Q.

A metal inter-sheath just on the inside or on the outside of the weak spot P would reduce the tendency of the weakness to spread, would reduce the I^2R loss and, without any question of the sheath being held at a definite potential for grading purposes, would strengthen the dielectric simply by its presence.

Assessment of Cable Quality.—Attention is being given by cable purchasers to (i) the drafting of specifications and (ii) tests in order to ensure that the cable shall meet all the condi-

tions of service satisfactorily. Apart from fixing the design, or approving a design submitted by the cable maker, there is a good deal to be said for matters under (i) being left to the manufacturer. In considering (ii) it will be appreciated that the tests which are suitable for cables to work on lower voltage are not suitable at 33,000 volts and upwards. The two

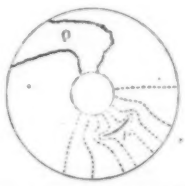

Fig. 15.—Effect of Irregularity on Dielectric Current.

guiding principles which might receive more attention by purchasers in selecting tests for use in accepting high-voltage cables are:—

(*a*) The tests which may shorten the subsequent life of the cable in service should as far as possible be restricted to special test-pieces not to be used afterwards.

(*b*) The object of using high-voltage cables is to lower transmission costs, and this object is partially defeated when the tests are made unnecessarily complicated and expensive, as the cost of the tests must be added to that of the cable. Tests on the thermal properties of a drum length, for instance, are very interesting, but, in view of all the other factors, are of minor importance to-day for acceptance purposes.

Discussion in London.

Mr. S. W. MELSOM congratulated the author on having avoided the error of being too assertive, which had been noticeable in several recent papers. Whilst inclined to agree with the author's theoretical treatment of the subject, a good deal more experimental work would have to be carried out before his theory could be finally accepted. The assessment of cable quality needed a good deal of elucidation; it could have been made the subject of a paper to itself, and if the author had confined himself to that alone he would have earned the thanks of both makers and users of cables.

Mr. L. EMANUELI, who was visiting this country from Italy, was specially welcomed by the President. While he agreed with several of the author's ideas, unfortunately the physical conception of what happened in a dielectric and upon which a mathematical theory could be built, was incomplete. However, the author's theory was the most probable one. The experimental part of the paper was incomplete, and a very important point in h.p. cable manufacture was the change in power factor caused by lowered insulation. The power factor diminished as the temperature increased, because the compound expanded and filled empty spaces. That part of the paper which dealt with cable breakdown was the most important. He referred to a paper he recently read before the International E.H.P. Conference, in which he described experimnts which showed that ionised air-pockets tended to displace the compound, which was sometimes accompanied by frothing, and in some cases it actually changed chemically. This was the probable reason of breakdown. A cable had been in successful operation in Italy at 130,000 volts for 18 months and it only differed from lower-voltage cables in that air and gas bubbles had been entirely eliminated from the insulation. Concerning inspection tests, he thought the ionisation test was better than the d.c. low-pressure test. To measure the power factor by passing current through the cable was apt to damage the dielectric, and he recommended the use of a constant-temperature bath. He hoped it would not be long before all cable makers would be able to come to some sort of agreement.

Mr. H. A. RATCLIFFE explained that his undertaking had some 60 miles of 33,000-volt cable "more or less" in commission; that was to say, he had had his share of the troubles inseparable from a new technical development, but some of that cable had been in uninterrupted operation for six years. The author's explanation of dielectric charging phenomena threw valuable light on what happened inside a cable, and his views on that subject merited serious consideration. Dielectric stress tests should be made on experimental lengths, and not on the cable itself. What the cable user wanted to know was whether a cable could be expected to last for, say, 25 years under ordinary working conditions. He felt that transient phenomena were very much over-rated, and that when they did occur there was generally some definite explanation for them. He had abolished the use of spark gaps and surge arresters on 6,600-volt cables, whilst those installed on 33,000-volt cables had functioned rarely, if ever; the cables themselves provided the best sort of arrester for that sort of thing. The maximum stress theory had little bearing on a cable's actual behaviour; cable makers had rushed to the other extreme, but it was significant that they were now increasing the thickness of core walls again; 3-core cable breakdowns were as often as not due to mechanical rather than electrical causes.

Mr. H. A. ALLEN inquired whether the author had attacked charging currents from the point of view of the late Dr. Steinmetz, as expressed in his paper on "Cable Charge and Discharge." It provided an accurate method of comparing the qualities of different cables. In connection with fig. 12 it had not been stated which curve was due to the heavier oil. The explanation might be that infinitesimally small air bubbles were occluded in the insulation; the bubbles might exist among, and even inside, the fibres of the paper, but it was uncertain whether they were necessarily deleterious. Supposing that such finely divided air existed, as the temperature increased the oil expanded and compressed the air, so improving its dielectric properties and reducing the loss to a minimum.

Mr. C. J. BEAVER, having "taken off his hat" to the first part of the paper, said he must "take off his coat" to the latter half. The I^2R theory had nothing to do with what occurred inside a cable and it did not explain the deterioration of papers during h.p. tests. He had not known that to happen except in the case of material that had been exposed to the air. It was neither electrostatic dispersion nor ionic flow (as had been suggested by Mr. L. Emanueli), but hydrostatic dispersion. The author had initiated another school of thought in this matter; 90 per cent. held the ionisation theory and the remaining 10 per cent. the moisture theory, but the factor that ultimately determined the breakdown of a cable was the amount of energy dissipated into heat per unit volume of dielectric. The statement at the end of the paper attributed to him by the author was incorrect.

Major A. M. TAYLOR was pleased the author considered that intersheaths improved the dielectric strength of cables. Intersheaths enabled the puckering of the paper to be checked and even eliminated, and their use also made it possible to control more effectively the temperature of the different sections of the cable.

Mr. H. C. SILVER suggested that more attention might be devoted to the measurement of resistance and less to the electric strength. Was it possible that the passage of an electric current through the dielectric converted it into a partial conductor by chemical action, which could only take place in the presence of moisture?

Mr. G. W. ADDENBROOKE pointed out that dielectrics in an even field behaved differently to dielectrics in a cable. Mixing two substances together gave different results and that was the explanation of the dip in the curve of which the author made so much. Much of the moisture in the oil when the cable was tested went into the paper under the influence of heat, and it later returned; that was a part explanation, but an increase of pressure would reduce losses. Pressure had a great influence on resistance, but not on capacity, which was a point not mentioned in text books; it pointed to absorption losses being due to moisture and not to the material. What was needed was a pure physical explanation of what occurred inside a cable.

Mr. W. D. OWEN was surprised at the author's admission that the time factor was a new phenomenon. The breakdown value fell with time and not at a constant rate; thus, the breakdown value of a dielectric could not be referred to in terms of a given time. A safety factor was a ratio, but in the case of cables of which two factors?

Mr. P. DUNSHEATH said he would reply to the points raised in full in the I.E.E. *Journal*.

A Fire-Extinguishing Demonstration.—We recently witnessed a demonstration given by the Total Fire Extinguisher Co., Ltd., of the "Total Fire Extinguisher," a product of the company, designed to deal with incipient fires irrespective of their origin, which is to be manufactured in this country in the immediate future. The apparatus consists primarily of a powder container and a steel cylinder containing liquid carbonic acid. The powder, a special preparation which, when heated, generates CO_2, is expelled from the container to the fire under the influence of the acid in the cylinder which is emitted in gaseous form through a suitable operating valve and nozzle to the powder container. The latter is fitted with a safety valve designed to work at 45 to 60 lb. per sq. in. pressure. The CO_2 cylinder is of seamless drawn steel tested to the standard requirements; it is, of course, suitably connected to the powder container. The apparatus is held in a bracket which protects the operating valve by a cover and also the discharge nozzle by a shoe. When suspended the "extinguisher" is held with the operating valve at the top. Should the apparatus be tampered with the cover opens, breaking the seal, and displays a red-light signal. The principle of the working of the "Total" is to cut off the supply of atmospheric oxygen to the burning object and surround the latter with a dense volume of the mixed extinguishing medium. The force with which the cloud is ejected enables the operator to fight the fire in a confined space. A question of considerable interest to the station engineer is that it is claimed that the extinguishing medium is a non-conductor of electricity, and that, therefore, the apparatus is suitable for fires of electrical origin, or where there is a danger of making contact with live conductors. At the demonstration structures of tar barrels and timber soaked in tar and petrol when burning furiously were dealt with by the "Total" with immediate effective results. The apparatus is manufactured in several sizes, from the small domestic size, which can be conveniently operated and carried by one person, to much larger ones carried in a cradle mounted on a pair of wheels. The largest type of extinguisher used at the demonstration holds 165 lb. of powder.

Notes from New Zealand.

(From Our Own Correspondent.)

Mangahao Inadequate.

The remarkably rapid growth of hydro-electricity in New Zealand may be gauged from the fact that already the Government's huge undertaking at Mangahao is threatened with a permanent overload. When this big project was first completed some eighteen months ago it was confidently expected that it would meet all the requirements of the district for some years at least, and it was even suggested that the Government would have some difficulty in disposing of available current. With the progress of reticulation, however, and the rapid growth of popularity of electricity as an illuminant and power agent, it now transpires that the various Power Boards in the district are anxious to acquire power far in excess of Mangahao's capacity.

The Government is now faced with the immediate necessity of constructing the second Mangahao dam for storage purposes, and the completion of this work will temporarily cope with the situation. The chief electrical engineer, however, has expressed the opinion that at the present rate of increase in demand, even the second dam will be inadequate and the Government will be obliged to push on with the Waikaremoana scheme, a contingency that was not expected to eventuate for some years at least.

Mangahao's present capacity is 24,000 h.p., and it is at the moment the largest scheme in operation in the Dominion. When the Lake Coleridge duplications are completed Mangahao will fall into the second place, but both Waikaremoana and Arapuni projects will cause even the revived Lake Coleridge scheme to fade into comparative insignificance.

Growth of the Electrical Demand.

During the last six years in New Zealand over 50,000 h.p. has been supplied from completed schemes at a cost of approximately £2,200,000, which works out at an average of £45 per horse power. In the case of the Lake Coleridge project the capital expenditure to date amounts to £1,008,491, and the total net profit for the past twelve months amounted to £5,434, thus reducing the total deficiency to £17,738, while works are in progress to raise the capacity of this plant to 27,000 kW. The Mangahao plant has absorbed some £1,493,456 capital expenditure to date, but as this station has not yet had a full year's run it would not be fair to compare it with others. The Horahora scheme has absorbed £522,973 in capital expenditure and the yearly working returns show a final net profit of £21,192, after all outstanding deficiencies have been wiped off. The Waikaremoana plant is only a small development at the moment, the major scheme not having been commenced, but a capital expenditure of £77,314 has already been involved, while as a final result of the year's operations the net loss is £3,295.

So far as the Department itself is concerned, the financial position is fairly sound. During the year its assets were valued at £4,753,248. The net expenditure amounted to £4,373,809, leaving a credit balance at the end of the working year of £379,439. Legislative authority exists for the raising of £4,000,000, and there are proposals to transfer £1,000,000 from the accumulated surplus and to raise another £4,000,000, so that the total available funds will reach £9,000,000.

Licensing of Wiremen.

As a result of accumulated pressure from those most intimately concerned, and partly in view of the large number of fatal and other accidents resulting from inexperienced wiring in some installations, the recent Power Conference in New Zealand has submitted draft regulations for the consideration of the Government covering the licensing and registration of all electrical wiremen. It is the desire of the Power Boards that after April, 1926, no electric wiring shall be done in any part of the Dominion except under the immediate supervision of fully-qualified and experienced men. When one considers the serious liability to fatal accidents made possible by placing electric wiring in the hands of incompetent individuals, it is in the best public interest that some such safeguarding measure should be instituted. In addition to the Wiremen's Act requiring the licensing and registration of all wiremen, it is proposed to set up a Board to administer the Act. This Board will consist of representatives of the Power Boards, insurance companies, the wiremen themselves, and the Government. The functions of the Board will include the providing of an examination for wiremen, maintenance of a register, inspections, and the examination of complaints, endorsement of licences, &c. The necessary appeal Board for the wiremen will consist of a magistrate and two qualified assessors, and provision is also made for the punishment of offences under the Act by fines up to £20. The measure is desired by all sections of the community and particularly by the wiremen themselves.

A New Railway.

An important railway undertaking is about to be launched within sight of the city of Wellington, when the largest railway tunnel in the Empire will be commenced, to link Wellington with the big settlement areas of the Manawatu. This tunnel will enter the hills between the existing railway stations of Kaiwarra and Ngarauhanga and continue in a straight line to the portal near the existing Tawa Flat railway station, a distance of eleven miles. At the present time the Wellington-Manawatu railway line is severely handicapped by the steep and winding grades between Thorndon and Tawa Flat, where the run over this 13-mile section on a 3 ft. 6 in. gauge takes almost 50 minutes, and limits the trailing loads to such a minimum as to seriously interfere with the economic operation of the whole line. The driving of the new tunnel is expected to take a minimum of five years, but it is not expected to complete the work within about eight years at the least. When this work is completed the schedule will be reduced by some 20 to 25 minutes, greater trailing loads will be reduced by some 20 to 25 minutes, greater trailing loads will be possible, and it is anticipated that by that time plans will have been completed for the electrification of the whole of the suburban section as far north as Paekakariki at least—33 miles from the city. One important effect of this tunnel will be to bring a large tract of valuable settlement land within easy reach of the city and convert some thousands of acres of first-class seaside residential areas into suburban centres.

Electrical Material.

A large quantity of foreign electrical material has recently found its way into the New Zealand market, and has occasioned some little concern among dealers on account of the unsatisfactory results attendant upon its use. So far as inquiries have shown none of the poor material is of English manufacture, nor has it come through English firms, except in one instance, involving some lamps. Lamps seem to be the main supplies affected as these articles so easily advertise their inferiority, but there are several other lines, especially in radio materials, where the importations have proved unsatisfactory.

The Government is considering the question of setting up a Bureau of Electric Standards with a view to inspecting and testing all electrical apparatus and material imported into the country. At the present time a certain measure of inspection is being maintained by the fire underwriters as well as by some of the local bodies especially interested, but the rapid growth of electrical utilities is such that the matter must be handled on a large and comprehensive scale, and it would seem that the Government is the best authority to undertake the work. Government testing laboratories will be erected probably at Wellington and Auckland, and the supervising body will exert the same powers as a censor in examining all materials and refusing import entry in all cases in which goods fail to come up to the standard requirements.

Electro-Chemistry and Metallurgy.

Some Figures of Cost and Output.

(*Abstract of Chairman's Address*: MERSEY AND NORTH WALES (LIVERPOOL) CENTRE *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

MR. A. E. MALPAS, Wh.Sc., M.I.E.E., delivered his inaugural address as chairman of the above-named Centre of the Institution on November 2nd, choosing as his subject that of electricity as applied to the electro-chemical and electro-metallurgical industries. He briefly outlined the fundamental equations and reactions involved in the manufacture of calcium carbide and its derivatives, the oxidation of atmospheric nitrogen, the electrolytic production of gases, and the extraction of metals, relying principally on a very large number of lantern slides to illustrate the subject.

Pointing out that the largest outlet for calcium carbide was in the manufacture of cyanamide, the author remarked that the capacity of the American Cyanamid Co. at Niagara Falls was 75,000 tons per annum, and other plant in Germany and elsewhere was in operation on a more or less similar scale. The world capacity for the production of cyanamide was estimated at about 300,000 tons per annum, and, although at least 40 different compounds were produced from cyanamide as a raw material, probably the largest product was a nitrogenous fertiliser and in this field entered into competition with Chile saltpetre. One of the Norwegian water-power plants on the Hardanger Fjord, which was extended in 1914, absorbed some 50,000 h.p. for the manufacture of the carbide and some 6,000 h.p. for the conversion to cyanamide. From the Skjaldalsfos waterfall 130,000 was developed. Running at 100 per cent. load factor it was probable that the cost of generation did not exceed 0.04d. per kWh. The selling price metered as h.p. at the works transformer sub-station was 0.07d. kWh on the pre-war contract.

The home of the oxidation of atmospheric nitrogen process was also in Norway at Notodden, where over 400,000 h.p. was installed and 13,000 tons of air were blown through the furnaces every 24 hours. Some £8,000,000 had been spent on the development of the power plant and the equipment of the factories, equivalent to, say, £32 per kW installed. The heat recovered by the steam boilers per kilowatt-year expended in the furnace was equivalent to that of one ton of coal and was sufficient to supply the whole requirements for steam of the chemical processes involved.

Other solutions of the nitrogen problem had been found, more particularly that known as the Haber process and its modifications. Since this reaction was exothermic no great amount of power was required to maintain it once the reaction was started, so that the process was one that could be economically worked without the aid of cheap water power. The mechanical difficulties that had had to be got over in applying the equation in practice, had been solved in different ways by Haber, and later by Claude in France, and by Casale in Italy. The process was also being now worked on a large scale in England.

In connection with the electrolytic production of gases the Knowles cell was to-day probably the most widely used of the many variations, and it was gratifying to note that it was almost a local product in that it was manufactured on a large scale at Chester.

As a result of Sabatier's work on the hardening of oils by means of hydrogen, on which the supply of synthetic butter so much depended, the demand for hydrogen largely increased and was met partly by electrolytic methods and partly by other means, notably the Lane steam-iron process. To-day the electrolytic method appeared to be displacing the other processes. Still more recently, the demand for synthetic ammonia gas increased to such an extent as to necessitate further supplies of hydrogen and plant for producing it. Knowles cells capable of absorbing 20,000 kW and producing eight tons of hydrogen per day were at work, or shortly would be at work, not only in England, but in France, Italy, Russia, Chile, and other countries. Plant was now being erected in the French Pyrenees to absorb 11,250 kW and to produce 70,000 cu. ft. of hydrogen per hour, which would be used in the production of ammonia by the Casale process. Of minor importance, but still of interest, was the fact that there was a small Knowles installation at Bodio, in Switzerland, for the production of synthetic rubies. Oxy-hydrogen muffle furnaces were used, the supply of gases being produced electrolytically. Taking the cost of energy as 1/10th penny per kWh, the cost of hydrogen worked out at one halfpenny per metre cube for the power used.

Other gases than hydrogen were produced electrolytically by using an appropriate solution. The most commonly used was sodium chloride, giving chlorine at the anode and caustic soda and hydrogen at the cathode. The largest installation in the world was said to be the plant put down by the U.S. Government at Edgeware Arsenal, where 3,500 Nelson cells were installed for war purposes to give 100 tons of chlorine per day and the equivalent of caustic soda.

It was said that cells for the production of magnesium had been operated by the Magnesium Co. at Wolverhampton at 5,000 amperes, each taking 5 volts and giving an output of 100 lb. of metal per 24 hours, or 6 kWh per lb. of metal. It was thought that magnesium had a future before it for the production of light alloys and that it might some day compete with aluminium.

The output of aluminium had grown to very large dimensions, the raw materials used being bauxite and carbon. The crude material contained about 60 per cent. alumina and to refine it sufficiently for use required the expenditure of 8 tons of coal per ton of finished metal, which no doubt explained why the manufacture of aluminium had developed to the extent that it had done in England, the ore being first brought to the coalfields for refinement and afterwards treated in electric furnaces at one of the hydro-electric power plants. At the furnace each ton of metal required 25,000 kWh, so that at 1/10th penny per kWh the cost for electricity was £10 per ton.

The two hydro-electric installations in this country producing aluminium were those of the British Aluminium Co. at Kinlochleven, Scotland, and of the Aluminium Corporation at Dolgarrog, North Wales. At the Kinlochleven power house 35,000 b.h.p. was installed. The new installation at Lochaber would bring the total capacity up to 107,000 b.h.p. in a year of average rainfall. The Dolgarrog installation was capable of extension up to approximately 33,000 e.h.p. Both plants together should, when fully loaded, be able to turn out some 36,000 tons of metal per year and thus supply a large part of the world's consumption, which was said to amount to 45,000 tons in the year 1911. From figures published in 1910 it was estimated that the cost of power delivered to the Kinlochleven factories was 1/10th penny per kWh, including all charges from dam to switchboard, and that the cost would fall as the load increased. The cost of the power plant was given as £600,000 at that date and of the chemical plant £650,000, the equivalent of £17 and £18.5 per kWh installed respectively.

It was of interest to record that an installation built during the war at one of the hydro-electric plants in Italy for the production of aluminium had since been shut down and was turning over to the manufacture of synthetic ammonia. It would seem, therefore, that so far as aluminium was concerned, Britain should be able to hold her own, but that in order to foster other electro-chemical industries, everything possible should be done to reduce the cost of power production in this country.

Transmission Line Power Limits.

Mercury Rectifiers as Excitation Adjuncts.

THE power limit of transmission lines is a live subject. In the October issue of the A.I.E.E. *Journal*, Messrs. R. E. Doherty and H. H. Dewey point out the essential features to be considered in a study of the problem and call attention to an experimental investigation of the subject. The latter part of their paper discusses the possibility of increasing the limit of power transmission by improving the apparatus and the characteristics of the transmission circuits, and it is pointed out that no great development may be expected from any scheme yet proposed regarding a modification in line characteristics. With reference to the apparatus, it is possible to make some changes in the design of synchronous machines tending to "stiffen" them, such as higher saturation, larger air-gap, &c., but in general no radical improvement of this sort may be expected that does not materially increase the cost and decrease the efficiency of the machine. Attention is turned therefore toward such schemes of regulation, or compensation, of the synchronous apparatus as would increase the maximum power. Among these is the use of reactors for locally controlling power factor and thus too the field excitation of the more important synchronous machines. However, the possible additional power thus obtained is limited, and, as it now appears, other and simpler methods which have greater promise will be resorted to.

Without expressing any assurance of practical application in the near future, it is noteworthy that a very substantial reduction in the effect of armature reaction has been actually obtained in a factory test by the use of the mercury-arc rectifier, as an adjunct in the excitation system. Its function is merely to supply field current in rigid proportion to the armature current, thus compensating for the latter *at the time it occurs*. By the nature of the circuits, and the variation of power factor, the space phase could not, in this particular case, be what was required. Nevertheless, the reduction in effective armature reaction, as evidenced by increased maximum power at the same voltage, under steady state, was of the order of 50 per cent.

Let the significance of this be clearly understood. Two maximum power (steady-state) tests were made on a miniature 250-mile line with a 225-kVA generator supplying a synchronous motor of the same size. One test was made with an ordinary vibrating regulator controlling the voltage of each synchronous machine; the other, with the rectifier as an adjunct. In the first, the power was gradually brought up to 120 kW at 2,000 volts at both ends of the line, 7 amperes on the motor field, 7.5 amperes on the generator field, which was the maximum power the system could carry; a further increase caused it to break out of step. Then the rectifier scheme was tried and the load was brought up to the same point, but this power was *not* the maximum; it was further increased at the same voltage to 154 kW, or an increase of 28 per cent.

This test is mentioned merely to illustrate the principle discussed; the point involved is the difference between the slope of a curve and the value of the function itself. It is not the value of voltage, but the slope of the voltage-power curve that indicates the degree of stability. If a system, controlled by vibrating regulators operating on the exciter is gradually loaded to imminent breakdown, the control can usually be taken over by hand and the same load held. In other words, although such regulators are highly effective in load transients in increasing the excitation as load is thrown on, they, nevertheless, do not significantly increase the steady state ultimate maximum power at normal voltage, over that corresponding to a fixed field current. The reason is that, even with the regulator, the slope of the voltage power curve, in the first moment, is practically the same as if the regulator were not operating; and if it should be different during a sudden transient, it must ultimately return to the steady state and thus to the slope corresponding to constant field. An exciter with a low time constant may expedite the regulation, but as long as the voltage must drop before the regulator contacts close, and the exciter field must be brought up before the alternator field current is changed, the compensation cannot possibly occur at the time the armature reaction occurs.

If this fact is not appreciated, it may be taken for granted that if the bus voltage is regulated, it may be assumed in calculations of maximum power that the voltage is *constant*. This assumption is justified only if $dE/dP=0$. It has even been proposed that by placing automatically regulated synchronous condensers along the line at given intervals, one may consider each of these sections as a unit, and that whatever power it is possible to transmit over one of them at the given voltage, can be transmitted, excepting losses, from one section to the other for a distance of, say, 1,000 miles. Now this would be possible only with infinite generators and also infinite condensers—*i.e.*, such that the slope of the terminal voltage curve against reactive kVA supplied by the condenser is zero. To illustrate magnitudes, the maximum power of a 250-mile line at 220,000 volts, infinite bus at both ends, is about 225,000 kW; of a 500-mile line, 130,000 kW. According to the proposal, with a condenser at the mid-point, it would be possible to transmit 225,000 kW, neglecting losses, over the entire 500 miles of line. Actually, a condenser at the mid-point of, say, 70,000-kVA capacity, would increase the maximum power only from 130,000 kW to 156,000 kW—not to 225,000 kW. This rather indicates what might be expected if the length were extended to 1,000 miles.

It is well to mention that consideration should not be confined to cases of long-distance straight-away transmission only. The problem, to a limited extent, relates also to power lines and networks of moderate distances, and the extent will undoubtedly become greater as the blocks of power to be transmitted continue to increase; or, indeed, to tie connections of central station systems—to any, in fact, in which the power to be transmitted approaches the power limit of the system under the operating conditions.

The progress to date has been little more than the demonstration of the principle in actual test, but it affords sufficient incentive to actively pursue the investigation when it is realised that for distances of transmission much above 300 miles the power limit with present equipment is such as to make such projects questionable from an economic standpoint, while, at the same time, the development of American resources will require the use of lines of this length in the near future.

New Electrical Devices, Fittings and Plant.

(Readers are invited to submit particulars of new or improved devices and apparatus.)

An Improved Draw-out Switchgear.

A new design of switchgear for 3-phase circuits and pressures up to 3,300 V, has recently been developed by Mr. GEORGE ELLISON, Perry Barr, Birmingham. The illustration, fig. 1, shows one of several switchboards supplied to a South Wales colliery. It is made up of eight units for one incoming and seven outgoing feeders. Each one is suitable for 200 A, and comprises an automatic circuit breaker, the necessary instruments and bus-bars. They are joined together by the bus-bar chambers and links. The gear is claimed to be freely accessible for inspection and adjustment, in accordance with the British standard specification No. 116, without resort to compound filling. The breaker element of each unit can be

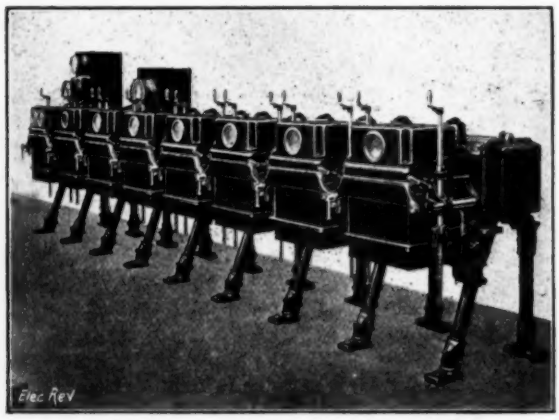

Fig. 1.—Draw-Out Unit Switchgear.

drawn out for isolating and the oil tank lowered without the use of auxiliary apparatus. Interlocks prevent access to current carrying parts unless the breaker is isolated. The trip coils are oil-immersed and the overload coils are direct connected in the main circuit; the breaker is operated by one handle, and easy operation is claimed without complication. The circuit is broken rapidly by two breaks in series, each 3 in. long, and the oil head is 6¾ in. above the points of break, assuring the safe rupture of high short-circuit currents; a welded steel tank is reinforced to withstand the shock of such an occurrence. A breaker may be entirely removed for overhauling and another mounted in its place if desired, or when the breaker is removed the aperture in front of the bus-bar chamber may be closed by a cover which can be locked up. Similar units may be arranged for the control of h.p. induction motors, in which cases the breaker is mechanically interlocked with a standard "Ellison" rotor starter erected in conjunction.

An Electric Sand-Pipe Heater.

The device illustrated in fig. 2, the Universal electric sand-pipe heater, is designed to keep sand pipes on locomotives, street cars and so forth, from clogging at the lower ends, and

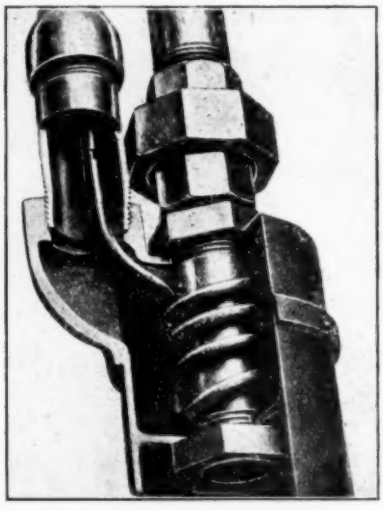

Fig. 2.—Sand-Pipe Heater.

has recently been patented in the United States. In stormy weather, the lower end of the sand pipe is always wet and it is a well-known fact that dry sand will not flow from a wet pipe without part of the sand sticking to the side of the pipe, eventually closing the outlet. The function of the device is to keep the orifice dry, permitting a flow of sand at all times, and thereby insuring full tractive effort and maximum adhesion for braking when needed. The heater is a simple device, screwed on the lower end of the sand pipe, simply making a shell which surrounds the pipe. Inside this shell and touching the sand pipe is an electric heating unit, which is supplied from the headlight generator. The heating element is covered with asbestos lagging, thus filling the space between it and the outer shell as well as retaining the heat.

Two sizes of heaters are manufactured, using 64 and 80 watts; two heaters are used on a locomotive.

Laboratory tests on the device were recently made by a large eastern railroad in the United States. Pipes were set up as on a locomotive and sand box and valves provided for track sanding. Water was allowed to trickle down the pipe and a blast of air equivalent to a cross wind blowing at 30 miles an hour was projected against the end of the sand pipe. Sand was permitted to flow down the pipe every 10 seconds. Without the heater the end of the pipe was closed with a groutty sand in from 5 to 15 min., while with the heater there was no wet sand in the lower end of the sand pipe at the end of 1¼ hours.

At a later date a road test was made. A five-gallon can of water was placed on the running board of a locomotive and a hose extending down to a point near the lower end of the sand pipe was used to trickle water on to the pipe. In making a 50-mile run without the heater on, the pipe clogged up every five minutes, being cleaned out each time. On the return trip, the current was "turned on" and the pipe gathered no wet sand. Again, another test was made in the freezing room of the Penn. Cress Ice Cream Company at Cresson, Pa., U.S.A. The sander was operated at a temperature of zero, with water trickling on the sand pipe. This was continued for two hours, at the end of which period there was nothing in the pipe.

The introduction of the electric sand pipe heater has solved the difficulty of obtaining a dependable flow of sand which arises from sand pipes stopping up, especially from the standpoint of safety. The patent is owned by a locomotive engineer engaged on the Pennsylvania Railroad.

An Electric Automobile-Engine Heater.

With the object of preventing the freezing of the water in the radiator and the engine cylinder jackets of motor vehicles when at rest in frosty weather, MESSRS. TURNCOCKS, Tunion Works, Aston, Birmingham, have recently introduced a simple device known as the Tunion electric automobile heater, fig. 3, which is intended to be placed under the bonnet of the car when the latter is put away for the night. It can be con-

Fig. 3.—Automobile Heater.

nected to an ordinary lampholder on a lighting installation, with a suitable flexible connection. The design of the heater is based on a current consumption of from 50 to 60 W, approximately the same as an ordinary metal filament lamp. The heat developed in the element is diffused over an area of 70 sq. in. of external surface from which to radiate. It is claimed that the working temperature is 200 deg. F. in free air. The heating elements are forced into an asbestos blanket under hydraulic pressure and firmly coated with polished bakelite.

Kaye Forced-feed Oilcans.

We have received a sample of a new "seamless" steel forced-feed oilcan which has been patented by MESSRS. JOSEPH KAYE & SONS, LTD., Lock Works, Leeds, who have recently received an order from the British Admiralty for 2,574 oil feeders made on this principle. Pressure on the thumb button ensures a jet of oil being forced to the spot required; the steel handle is riveted to the body of the can and the spout is double wrapped by a special process and is practically seamless. The top is fastened to the body of the can by means of serrated jointing. Various sizes are made, to hold from 1/16th to 2 pints, in steel and polished copper and brass.

An Appeal to the Student Engineer.

By W. F. MYLAN.

(*Abstract of Chairman's Address*; SHEFFIELD SUB-CENTRE *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

I WOULD like to make a special appeal to those, who, qualified in every way, are not yet members, to take the necessary steps to become attached in an appropriate grade to this Sub-Centre and thus make it fully representative of the electrical engineering profession in this area. In this connection I address myself particularly to the younger men who are at the commencement of their careers.

The problem of increasing the value of the Sheffield Students' Section has been and is constantly receiving the attention of your Committee, which feels that, however great its efforts and how extensive its plans, the results will not be satisfactory unless a greater number of the younger members will actively take part in, and support by their attendance, the various meetings, discussions, and visits to works that may be arranged; and, more important still, by coming forward with papers to be presented before their fellow members. The Institution grows stronger and of more value to its members each year and to the younger men who have their careers in front of them, active membership can be of the greatest possible help and assistance, no matter on what lines their work may be proceeding or in what branch of the industry it is their intention to embark.

There is no branch of engineering, with the possible exception of aviation, in which recent progress has been so rapid and in which there is such an ever-widening future, and it would be a mistake on your part to assume that because a paper is one which at the moment does not appeal to you, you may miss the meeting at which it is read. Very shortly after you may find that to you the subject dealt with has become one of extreme importance.

The preparation and presentation of a paper is one of the most useful pieces of work the young engineer can undertake. You will not only be doing a helpful service to your brother engineers by presenting to them in a brief and concise form the information you have collected together by reading, investigation and observation, but you will have improved your own knowledge of the subject dealt with. Try and take a share in the management of the section; don't leave this work to a few individuals. The experience gained as an officer or committee man will be useful in many unexpected directions. If a visit is arranged you should particularly make a point of being present. Quite apart from what you will see and learn of the practical application of electricity, it is a matter of courtesy to show your appreciation of the privilege granted to your section by attending. The young engineer should seize every opportunity of seeing how the many problems met with in engineering have been solved in different ways, and the practical applications of the theories which have been presented before him in the lecture room or in the text book. I feel that some apology is necessary to the senior members for dealing with these matters in a somewhat elementary form; but the student of to-day is the associate member or member of to-morrow, and if we are to see the Institution of Electrical Engineers maintain its true position in the engineering world, too much encouragement and assistance cannot be given to the younger element.

The matter is of greater importance still since we as a nation must keep in the van of progress, and to do so we must see that our young engineer is given every help and encouragement to fit him for the battle of life. Twenty to twenty-five years ago it could be said with some justice that in many branches of electrical engineering our competitors were greatly in advance of us, not only in excellence of design, efficiency of operation and performance, but also in the skilful application of electricity. Furthermore, their prices were usually lower than ours. To-day, thanks to that characteristic of the British as a nation, never to admit defeat, it would be difficult to point to one important branch of the electrical industry and profession wherein we are not at least equal to, and in many instances vastly in front of, our competitors and able, given equal economic conditions, to compete with them on price. To keep this position we must continue to advance, and to do so must ensure an adequate supply of fully trained workers equipped in every direction. I believe we are just verging on the period which will be known in after years as the electrical age. Some countries are much nearer to it than we are. Several nations are consuming two, three, four, or even five times as many kWh per head of population as we are. This may be only a very rough method of comparison, but it certainly would appear that there is ample scope for the electrical industry, especially when it is remembered that we are still a great manufacturing country, although perhaps not quite holding the predominant position that we did in the past. To retrieve that place should be the aim of all, and electrical engineers can here perform a very great part. It behoves we senior members, therefore, to do our share in helping on the young electrical engineer, and I would suggest to all of you, who are in close contact with the young men of our profession as friends and employers, to use your influence to get them to take an active interest in the work and meetings of this Institution. Five years ago we had 36 students attached to this Sub-Centre, to-day we have 52. Many of the original 36 will by this time have passed forward to other grades of membership, but there must be still a large number of young engineers who ought to be members of the Students' Section, and I suggest that a little active personal propaganda work on the part of the senior element would soon result in our Students' Section becoming a very live and useful body.

This country is passing through very trying times. Many of our industries are struggling for their very existence, and whilst the electrical industry is perhaps more fortunate than many others, we all have to face the intense foreign competition. Much of this is unfair, much of it is due to unequal economic conditions; practically none of it due to the superiority of the article offered. To all of you, I make an urgent appeal; be your purchases little or great, make sure above all, whenever you can, that you are buying British goods. Whether a product of the home trade or of our Colonies do insist that it be British throughout.

Correspondence.

Correspondents should forward their communications* at the earliest possible moment.** ***No letter can be published unless we have the writer's name and address in our possession.

Is the Contracting Industry Degenerating?

In reply to Mr. T. Critchen's letter, I do not suggest that the regulations be slackened—what I would like to see would be the rule and regulation makers taking a few years' holiday and letting us get on with our work.

Had they taken their holiday in 1917 we should still be working on the Institution rules of that date, which are good enough for Mr. Fennell, of the Northwich Supply Company, and for many other members of supply companies; the mischief lies with the corporation supplies and the urban and rural districts, who each have their own book of rules, which in most cases they cannot enforce.

As an instance of the difference between 1917 and to-day, on a new job, the vacuum cleaner, iron, and radiator must be earthed (I have used all these things for eleven years without earthing them, without fatal or any other results, with three children growing up in that period). Once, however, the job is passed, it is open to the consumer to go to any shop or store and buy electrical devices, such as curling tongs, hair driers, violet-ray machines, radiators, &c., in many cases taking delivery over the counter; we, or any dealers, are not interested as to where they go so long as the sale is made. None of these items has an earth wire attached to it by the makers, and I am quite sure the dealers do not put one on, so that on a new job, we get some portion earthed and the later stuff not earthed; and if it is so dangerous, why are not the papers full of the accidents, fatal and otherwise, caused by unearthed apparatus?

Our only difficulty is to find out what the voltage is and if a.c. or d.c. is required, and that brings us to another difficulty, because in our area we have Altrincham 100 and 200 volts, Manchester 200 and 240, Salford and district 220 and 200, Ashton 240, Trafford Park 250, St. Annes 230; and it is only by careful cross-examination of the customer and knowing which is the new system and which the old, that we can fill an order.

I have sold many grosses of electric irons, hundreds of vacuum cleaners, radiators, kettles, &c., over the counter, having no further interest in the goods sold (unless they went faulty, when of course we heard about it); in this respect, why should we? We are competing with all the big stores in the country who are not contractors, but just purely salesmen.

I suppose the stores have the same sources of supply as the contractors, and in no single case is a piece of apparatus delivered to us with an earth wire—not even a washing machine, which most certainly should be earthed!

I am in entire agreement with Mr. Fennell and Mr. Critchen as to registration, and the sooner it is compulsory the better; at present the contractor is competing with wiremen and others working from private houses, carrying no stock, not helping the trade in any way, and probably out of business in a few months.

Manchester, *November 9th*, 1925. **E. O. Walker.**

Rural Electricity Supply.

In connection with this correspondence, it is interesting to note that the I.E.E. Informal Meetings Section, in its discussion on "How can the cost of Distribution be Cheapened?" elicited the fact that the Shropshire, Worcestershire, and Staffordshire E.P. Co. is erecting overhead distribution lines at about £400 per mile. This is much lower than the cost in many other parts of the country. However, it would be interesting to know why the cost could not be further very considerably reduced. In Sweden, as one instance, the cost of a line for a similar purpose is only about £100 per mile. What modifications should be made in this country to get somewhere near this figure without sacrificing public safety? It is not essential, for rural work, to provide an absolutely uninterrupted service; this fact enables costs to be reduced.

I know of lines in this country that have cost but little more than the Swedish example—but they have been erected without official sanction. However, I have constructed one at a similar cost, for which I have had the informal sanction of the

Electricity Commissioners. Hence it is not this body that stands in the light. It is further claimed in this correspondence that it is not the I.E.E. regulations or the P.O. Telephone Department, that put any really serious difficulties in the way.

It is a matter of very great importance to this country that the cost of overhead lines should be reduced; have any readers of the ELECTRICAL REVIEW any concrete suggestions that will facilitate the attainment of this end?

R. Borlase Matthews.

East Grinstead, *November 14th*, 1925.

The Cost of House Wiring.

Referring to "Inquirer's" letter under the above heading in your issue of the 13th inst., this we read with interest, and we would like to give our experience that as regards house wiring we find our keenest competitors are members of the E.T.U. who, when working on their own behalf, will complete a seven-point job in about 9 or 10 hours, but when taking 1s. 10d. per hour from us for their labours, our experience is that they take nearer one week, hence the impossibility of such competition for this class of work.

Heath Pritchard, Ltd.

London, *November 14th*, 1925. S. E. GRUBB, *Director*.

Legal.

Metropolitan-Vickers Electrical Co., Ltd., v. British Thomson-Houston Co., Ltd.

THE Court of Appeal, consisting of the Master of the Rolls and Lords Justices Warrington and Sargant, on November 11th reserved judgment in this case upon the appeal of the plaintiff company from the judgment of Mr. Justice Lawrence in the Chancery Division, holding that Rosenberg's patent for improvements relating to synchronous dynamo-electric machines, of which the plaintiffs are the owners, had been anticipated by Tesla's U.S.A. publication, but that if it had been valid it would have been infringed by the defendants, the British Thomson-Houston Company, Ltd.

Radio Instruments, Ltd., v. Super Radio Co.

IN the Chancery Division on November 10th, a motion in an action by Radio Instruments, Ltd., against the Super Radio Co. was mentioned to Mr. Justice Tomlin.

Mr. BOUSFIELD, for the plaintiffs, said it had been agreed to treat the motion as the trial of the action and the defendants would submit to a perpetual injunction with costs.

Radio Instruments, Ltd., v. Lesadd & Sons.

IN the Chancery Division on November 13th, Mr. Justice Tomlin had before him a motion by Radio Instruments, Ltd., for an injunction restraining Lesadd & Sons, Ilford, from infringing its patent in relation to radio instruments by selling them below the stipulated price.

Mr. BOUSFIELD, for plaintiffs, said that the defendants were prepared to treat the motion as the trial of the action, to submit to a perpetual injunction, and to pay two guineas as damages and 20 guineas as costs.

His LORDSHIP made an order accordingly.

Postmaster-General v. Ford.

THE adjourned summons obtained by the Postmaster-General against Mr. Robert Moffatt Ford, Albert Gate, S.W., came before Mr. Mead at the Marlborough Street Police Court on November 12th. The charges were that the defendant had established a radio station, installed apparatus, and worked the latter without a licence. Mr. Ford pleaded "Not guilty," and conducted his own defence. Evidence was given by Post Office officials of the discovery of the apparatus in defendant's house. Mr. E. H. Shaughnessy, assistant engineer-in-chief of the G.P.O., said that the apparatus found had been tested and ascertained to be capable of receiving messages, when a "cat's-whisker" and telephones were added. The witness said that any combination of apparatus which would receive radio signals constituted a "station," and unassembled parts were "wireless apparatus."

As defendant said that his closing statement would occupy some time, the magistrate again adjourned the case for a fortnight.

Consolidated Electrical Co., Ltd., and Allen & West v. London Woollen Co., Ltd.

IN the King's Bench Division, on November 12th, Mr. Justice Avory gave judgment in favour of the plaintiffs in this case, holding that they were induced by misrepresentation to take up certain shares in the defendant company.

False Pretences Charge Dismissed.

AT the Marlborough Street Police Court on November 13th, the Magistrate discharged Hyman R. Spinney, electrical engineer, who was charged with obtaining by false pretences telephones valued at £412 10s., the property of the General Radio Co., Ltd.

Trade-mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from November 11th. In the case of foreign applications, the names and addresses of the British representatives are also given.

Superselectodyne. No. 460,255. All goods in Class 8. No. 460,257. All goods in Class 13. Supertetradyne. No. 460,258. Superpentadyne. No. 460,259. Superhexadyne. No. 460,266. All goods in Class 6.—Société Française Radio-Electrique, 79, Boulevard Haussmann, Paris. (Marks & Clerk, 57-58, Lincoln's Inn Fields, W.C.2).

Audalion (lettering and design). No. 457,674. Class 8. Loud speaker devices and telephonic receiving instruments.—Lee de Forest, 220 West 42nd Street, New York, U.S.A. (Frank B. Dehn, 101, Kingsway, W.C.2).

Kathodofone. No. 460,426. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—Die Tri-Ergon Gesellschaft, 7, Tiefenhöhe, Zurich, Switzerland (A. M. & W. Clark, 53-54, Chancery Lane, W.C.2).

Kenmac. No. 461,327. Class 8. Apparatus for use in radio-telegraphy and telephony.—Kenmac Radio, Ltd., 2a, Dalling Road, Hammersmith, W.

Davreach. No. 461,528. Class 8. Radio-telephonic apparatus.—E. H. Millington, 5, Vaughton Street South, Birmingham.

Hitensite. No. 462,558. Class 8. Paper-insulated electric cables. Kalanoid. No. 461,068. Class 50. Electric insulating material composed of a mixture of levigated earth, oil, waxes, and bitumen. Emfinite. No. 462,775. Class 8. Electric cables.—Callender's Cable and Construction Co., Ltd.

Milliwatt. No. 458,302. Class 11. Electric heating cushions and pads.—Richard Heilbrun, 27 28, Lindenstrasse, Nowawes, Germany (Mathys & Co., 52, Chancery Lane, W.C.2.)

Musikon. No. 460,466. All goods in Class 8.—Will Day, Ltd., 19, Lisle Street, W.C.2

Phonalion. No. 461,296. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—The G. & L. Electrical Supply Co., Ltd., 1, Warwick Court, High Holborn, W.C.1.

Music Master (lettering and design). No. 460,969. Class 8. Receiving sets, sound reproducers and amplifiers, all for use in radio-telephony, and electric batteries.—The Music Master Corporation, 128, North Tenth Street, Philadelphia, U.S.A. (F. W. Golby, 3, John Street, Bedford Row, W.C.1.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1924.

17,376. "Variable electric couples or inductance devices for wireless apparatus." London & Provincial Radio Co., Ltd., and E. Duckworth. July 21st, 1924. (241,614.)

17,447. "Wireless telephone transmitting systems." H. R. C. Van de Velde, J. Stewart, and E. H. Trump. July 21st, 1924. (241,617.)

17,448. "Radio-receiving sets." P. W. Willans. July 21st, 1924. (241,618.)

17,536. "Circuit-controlling means for electrical train-control apparatus." R. Haddan (J. B. Regan). July 22nd, 1924. (241 623.)

17,866. "Means or apparatus for transmitting motion to motor vehicles propelled by electric or other power." F. E. Popplewell. July 26th, 1924. (241,633.)

18,321. "Direct-current supply systems." British Thomson-Houston Co., Ltd., and F. P. Whitaker. July 31st, 1924. (241,642.)

18,623. "Methods of and apparatus for signal reception." British Thomson-Houston Co., Ltd. August 3rd, 1923. (220,004.)

18,916. "Means for reducing the glare of head-lamps." O. C. Worthington. August 8th, 1924. (Cognate application 24,136/24.) (241 648.)

19,209. "Electrical transformers." G. W. Hale and Radio Engineering Co., Ltd. August 13th, 1924. (241,653.)

19,332. "Circuit arrangements for automatic telephone systems and the like." Siemens Bros. & Co., Ltd., and W. G. Patterson. August 15th, 1924. (Cognate application 23,242/24.) (241,655.)

19,521. "Wireless receiving apparatus and the like." J. Gaunt. August 18th, 1924. (241,656.)

19,894. "Control of electric traction motors." Metropolitan-Vickers Electrical Co., Ltd. (Westinghouse Electric & Manufacturing Co.). August 22nd, 1924. (241,660.)

19,988. "Electrical devices such as variable electrostatic condensers, variable inductances, and the like." H. H. Andrewes and Dubilier Condenser Co., Ltd. (formerly Dubilier Condenser Co. (1921), Ltd.). August 23rd, 1924. (241,663.)

20,162. "Electric motor control systems." English Electric Co., Ltd., and F. D. H. Bremner. August 26th, 1924. (241,662.)

21,477. "Wireless or electrical terminals, couplings, and the like." L. H. Reid. September 11th, 1924. (241,674.)

22,157. "Systems of electric distribution." British Thomson-Houston Co., Ltd. September 20th, 1923. (222,140.)

22,418. "Electrical apparatus for the measuremtnt of the level and flow of liquids." G. F. Shotter. September 23rd, 1924. (241,684.)

23,392. "Electric cooking utensils and other like apparatus, and an element therefor." A. C. Ireland. October 3rd, 1923. (222,884.)

23,397. "Rheostats." Igranic Electric Co., Ltd., and W. K. Alford. October 3rd, 1924. (241,694.)

25 181. "Head telephone receivers." Schneider Maschinen-Werke Ges. F. July 30th, 1924. (237,854.)

25,558. "Electric condensers." Dubilier Condenser Co., Ltd. (formerly Dubilier Condenser Co. (1921), Ltd.) (W. Dubilier). October 27th, 1924. (241,716.)

26,007. "Electrical apparatus for the elimination of aperiodic disturbances." H. J. J. M. de R. Belescize. July 22nd, 1924. (Addition to 226,784.) (237,547.)

27,363. "High tension thermionic valves." Siemens & Halske Akt. Ges. December 4th. 1923. (225,836.)

28,471. "Sparking devices for internal-combustion engines." R. J. Koster and F. E. Bright. November 27th, 1924. (241 740.)

29,806. "Method for the production of connectors for bonding electric rails." J. G. Kjellgren. December 11th, 1924. (241,749.)

30,611. "Telephonic repeating systems." International General Electric Co., Inc. December 22nd, 1923. (226,500.)

30,806. "Railway or tramway rail joints." E. A. Byrde. December 22nd, 1924. (241,754.)

1925.

2,022. "Electrical measuring systems." J. H. Beaumont (Naamloze Vennootschap Instrumentfabriek en Handel voorheen P. J. Kipp & Zonen). January 22nd, 1925. (241,772.)

5,699. "Electrical contact plug." Deltavis Co. January 21st, 1925. (241,785.)

7,919. "Electrical contact plug." Deltavis Co. March 24th, 1925. (Addition to 241,785.) (241,794.)

8,415. "Protecting devices for electric detonators." H. L. Grant. November 6th, 1924. (241,796.)

9,704. "Spark plugs." M. F. Macdonald. May 1st, 1924. (233,325.)

9,927. "Variable electric condensers." L. E. Fillmore and L. W. Fillmore. April 16th, 1925. (241,805.)

11,172. "Safety device for electrically-heated vessels." Brompton & Kensington Accessories Co., Ltd., and A. Logan. April 29th, 1925. (241,812.)